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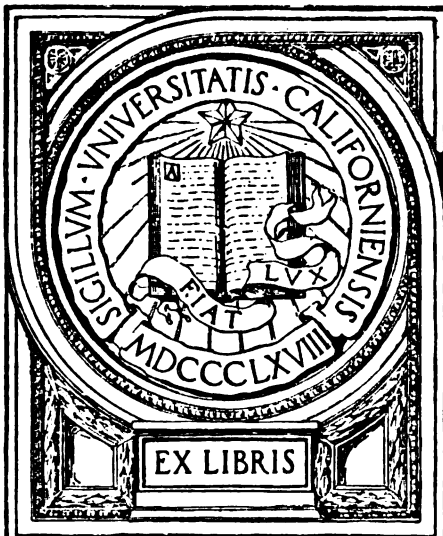
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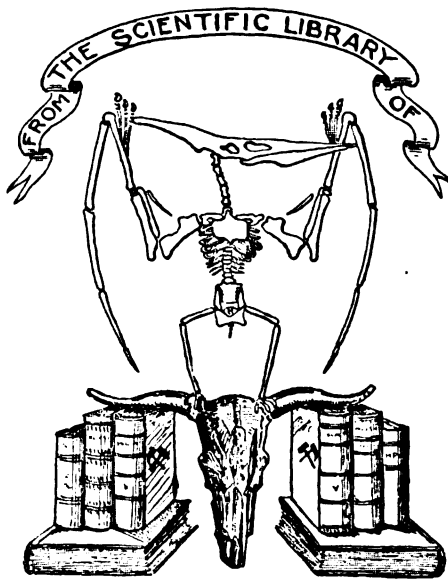
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WILLIAM DILLER MATTHEW



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PROCEEDINGS  
OF THE  
NEW ENGLAND ZOÖLOGICAL CLUB

Cambridge, Mass.

UNIV. OF  
CALIFORNIA

AN EXTINCT CUBAN CAPROMYS.

BY GLOVER MORRILL ALLEN.

IN a previous paper (Bull. Mus. Comp. Zool., Jan. 1917, vol. 61, pp. 1-12), I described a subfossil insectivore, a *Geocapromys*, and a small species of *Boromys*, on the basis of cranial fragments recovered from a piece of bone-breccia sent from Cuba to the Museum of Comparative Zoölogy by Professor Carlos de la Torre. The bone-breccia was found in a limestone cavern in the Sierra de Hato Nuevo, Province of Matanzas. This locality has lately been revisited by Dr. Thomas Barbour, who collected a quantity of subfossil bones from the same cave. He found them in a layer a short distance beneath the surface of the floor deposit, and was fortunate in discovering several pockets where the bones were loose in the earth, and not solidified together by limy deposition. The greater part of the deposit had already been removed in the course of years by the local planters, who use the cave earth as a fertilizer. The original mass must have been considerable, the accumulation of a long period of time. The greater part of the bones recovered are those of *Geocapromys* and *Capromys pre-*

*hensilis*, mainly immature. Their scattered and fragmentary condition may be explained in part by the probability that the animals from which they came were brought thither by owls, and either they were torn apart in the cave or their bones were regurgitated as owl 'pellets.'

In examining the material brought back from this cave and from the Macha cave, near Limones, several jaws of a very small *Capromys* were discovered, apparently representing an undescribed species which in life could hardly have been much larger than an adult house rat. Even the youngest *Capromys prehensilis* available, in which the last lower molar has just reached the tooth-row, has much larger and broader teeth, and a longer tooth-row, than the old adult of this small species. A young or immature jaw of this genus is easily recognized by the nature of the bony capsule surrounding the last molar; it is thin and porous in texture, and its outline is rounded. In an adult, however, the bony alveolar wall is solid, its posterior edge thickened to form a narrow ledge, and produced backward as a vertical keel. This dwarf species may be known as

### ***Capromys nana*, sp. nov.**

*Type*.— A right lower mandible, no. 9864, Mus. Comp. Zool., from a cave deposit in the Sierra de Hato Nuevo, Province of Matanzas, Cuba, collected by Thomas Barbour.

*Specific characters*.— A small species with a tooth-row about two thirds the length of that in the adult *C. prehensilis*, and with proportionally narrower teeth; angular process of the jaw, however, relatively shorter and broader.

*Description*.— The type jaw retains all the teeth, but the coronoid and angular processes are broken off. The strikingly narrower and smaller teeth, as compared with *C. prehensilis*, the smallest of the living species, and the less massive proportions of the jaw, are characteristic, and are well brought out in the measurements given below. The enamel pattern of the teeth is essentially similar, except that the anterior point of the first molariform tooth is nearly in the axis of the tooth-row instead of nearer its inner border. The shape of the angular process is characteristic.

It is relatively much broader and flatter in ventral aspect than in *C. prehensilis* or in *melanurus*, with a deep, rounded notch on its inner outline, instead of being long and narrow with only a slight indication of a notch. In lateral aspect the broad ledge formed by the angular process is wider anteriorly, and bounds a deep pocket-like depression, where in other species of *Capromys* the surface shows only a shallow and evenly hollowed groove for muscle attachment. The incisors are pure white.

*Measurements.*—The type measures: alveolar length of tooth-row, 12.5 mm.; crowns of cheek teeth, 12.2; crown length and breadth of  $pm_4$ ,  $3.6 \times 2.6$ ; of  $m_1$ ,  $3.0 \times 3.0$ ; of  $m_2$ ,  $2.7 \times 3.2$ ; of  $m_3$ ,  $2.9 \times 2.9$ ; diastema, 10.5; greatest depth from alveolus of  $pm_1$ , 9.0; from back of condyle to anterior end of socket of incisor, 35.5; from summit of condyle to ventral surface of angular process, 17.0. The lower tooth-row of an adult *C. prehensilis* measures 17.5 mm., and the breadth of the crowns of the molars, 4.3.

A fragment of a maxilla referred to this species (no. 9875) shows the alveoli of the three anterior teeth. These alveoli measure respectively:  $pm^4$ ,  $3.6 \times 3.0$ ;  $pm^1$ ,  $3.0 \times 3.0$ ;  $m^2$ ,  $3.0 \times 2.9$  mm.

*Remarks.*—The ten jaws examined are all quite similar, and agree closely in the small size of the teeth, the relative lightness of structure, and the possession of a deeper depression in the outer face of the jaw, where the angular process comes off. There can be no doubt that they represent adults of a much smaller species than any heretofore known.

It should be recalled here, that Peters, in publishing Poey's description of *Capromys melanurus* (Monatsb. K. Preuss. Akad. Berlin, 1864, p. 384) added in a footnote: "Hr. Poey schreibt mir noch von einer zweiten neuen Art, *C. pallidus*, welche sich von allen anderen durch ihre geringere Grösse und die blonden, ungeringelten Haare unterscheidet." This probably refers to an albinistic form of either *melanurus* or *prehensilis*, such as occurs not uncommonly with yellowish "ungeringelten" hair. Such individuals, as Mr. C. T. Ramsden of Guantanamo tells me, are believed to live in gray-barked trees. The lesser size ("geringere Grösse") is not further specified, and may have been due to youth. At all events, the name *C. pallidus*, based on hearsay report, cannot be satisfactorily identified, much less applied to the small subfossil species here described. The latter may not have become

extinct until after the discovery of America; but at all events the bones studied are well mineralized and seemingly much older in appearance than those of the introduced house rats, a few of which are present in the material brought back. Had this *Capromys* survived until Poey's day, it is unlikely that Gundlach would have failed to discover it.



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**NEW FOSSIL MAMMALS FROM CUBA.**

**By G. M. ALLEN.**

**WITH ONE PLATE.**

**CAMBRIDGE, MASS., U. S. A.:**  
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**JANUARY, 1917.**



No. 1.— *New Fossil Mammals from Cuba.*

BY GLOVER M. ALLEN.

THE recent discoveries of fossil mammals in Porto Rico, San Domingo, and Cuba (Anthony, 1916, 1916a; Miller, 1916a) indicate the former existence in these islands of a very interesting and remarkable assemblage of indigenous species many of which have probably become extinct within only very recent times. The remains hitherto discovered represent five extinct genera of hystricine rodents (not including *Amblyrhiza* of Anguilla and St. Martin's), at least two genera of ground sloths, and a new family of insectivores (*Nesophontidae*). Further systematic search will doubtless disclose additional remains on other of the Antillean islands, the study of which must throw much light on the distributional problems of the West Indies.

The Museum of Comparative Zoölogy has received from Professor Carlos de la Torre, the distinguished Cuban naturalist, a fragment of bone-breccia obtained in the Province of Matanzas, Cuba, from a '*caverna*' — cleft or cavity as distinguished from '*cueva*,' a large cave. This block is less than one fourth of a cubic foot in volume, and apparently represents a complete section of the floor deposit, some four inches thick. The bottom portion consists of red cave earth, and a few limestone pebbles with much admixture of minute bone-fragments. The more superficial portion is almost entirely composed of small mammalian bones, indistinctly stratified, for the greater part crushed to microscopic fragments. The whole mass is mixed with particles of cave earth, and solidly cemented together by the deposition of lime from infiltrating water. As to the age of the deposit, there is of course no indication beyond the fact of its having been laid down in a cavern of no great antiquity. Presumably it is of Pleistocene or even more recent age.

In spite of the very fragmentary nature of the bones, and the solidity with which they were cemented together, a number of nearly complete jaws and palates were extricated. Lower jaws, as usual in such deposits, are best preserved and most frequent; portions of long bones, though common, were usually too broken to be of value. A careful study of the jaws and teeth recovered, reveals three very interesting new species. The first is an insectivore of a type probably

related to the newly described Nesophontes of Porto Rico. It is, however, a much smaller animal, and is likely to prove a representative of still another genus, though on account of the fragmentary nature of the only jaw discovered, this is still uncertain. The two other species are hystricine rodents, the one a small mouse-like species, probably related to *Brotomys* and *Boromys* (Miller, 1916a), the other a member of the short-tailed group of *Capromys*, for which Chapman (1901) proposed the subgenus *Geocapromys*. The last species forms by far the greater part of the bone fragments.

The subgenus *Geocapromys* has hitherto been known from three living forms only — *brownii*, *thoracatus*, and *ingrahami*, confined respectively to Jamaica, Little Swan Island, and Plana Keys (Bahamas). The discovery of a recently extinct species in Cuba is therefore important, as bridging in part the hiatus between the last two species, and definitely adding Cuba to the known range of the group. A study of all the living species of *Capromys* as at present understood, reveals an excellent tooth character by which the short-tailed members of the group may be distinguished, namely, the presence of an additional antero-internal reentrant in the enamel pattern of the first lower molariform tooth ( $pm_4$ ). This, in addition to other cranial and external characters, in part already pointed out by Chapman, is, I think, sufficient to raise *Geocapromys* to generic rank, as a related but more specialized group.

In working out the relations of the Cuban *Geocapromys*, it became necessary to consider more carefully Chapman's *Capromys columbianus*. This was described on the basis of two subfossil fragments of the maxillary with the palate, found in a cave near Trinidad, Cuba, buried a few inches from the surface. Associated with these were a molar (probably the last one in an upper series) and portions of bones which were doubtfully referred to the same species. The molar is, without much question, from a species of *Capromys*, but Chapman's excellent figure and description leave no doubt that his *C. columbianus* is an animal very different from other known forms of that genus. Indeed, as I have previously suggested (1911, p. 212) it is not even congeneric. Through the kindness of Mr. H. E. Anthony of the American Museum of Natural History, I have lately had the privilege of examining the type specimens and find my previous conclusions fully substantiated. In order to bring out more clearly the peculiarities of this animal, and to obviate any misconceptions of distribution that may arise through considering it a fourth Cuban species of *Capromys*, I therefore propose for it a new generic term:

## SYNODONTOMYS, gen. nov.

*Type Species*.—*Capromys columbianus* Chapman (1892, p. 314, fig. 3).

*Generic Characters*.—A *Capromys*-like animal of the size of *C. pilorides*, with a V-shaped palate that narrows anteriorly until the anteriormost molariform teeth ( $pm^4$ ) nearly touch the median axis, and are only separated from each other by the thin bony walls of their alveoli. Pattern of upper cheek teeth apparently similar to that of *Capromys*, with two outer reentrant folds of enamel and one median inner fold; but apparently these folds slope rather strongly forward (as indicated by the forward direction of the small vertical ridges of the alveoli) instead of being as in *Capromys* nearly transverse. In outline the molariform teeth are very nearly square instead of elongate or rectangular as in *Capromys*, and are subequal in size.

In the close approximation of the maxillary tooth rows, this genus recalls *Myocastor*, but differs in the tooth structure.

The three species found among the fragments in the block of bonebreccia from Matanzas are the following.

## INSECTIVORA.

## ?NESOPHONTES MICRUS, sp. nov.

Plate, fig. 14.

*Type*.—A posterior half of the right ramus, containing a part of  $pm_4$ ,  $m_1$ ,  $m_2$ , and the roots of  $m_3$ , M. C. Z. 9600. From a cavern in the Sierra of Hato-Nuevo, Province of Matanzas, Cuba. Carlos de la Torre.

*Description*.—The fragment indicates an animal considerably smaller than *Nesophontes edithae* of Porto Rico, but the jaw was evidently similar in the general form of the angulare and the ascending process. The ramus, however, seems proportionally more slender, without the depth of curve beneath the molars. The molars differ from those of the type species of *Nesophontes* (1) in being less elongate in the axis of the tooth row; (2) in decreasing in size from  $m_1$  to  $m_3$ ; (3) in lacking a certain 'plumpness' of form that is found in *Solenodon* as well; and (4) in the lack of a space between the posterior border of  $m_3$  and the ascending process of the mandible.

The fragment contains traces of two roots of a  $pm_3$ , and a nearly complete  $pm_4$  which, as in *N. edithae*, is two-rooted with a prominent posterior cingulum cusp. Both first and second lower molars have a cingulum on the anterior half of the outer aspect. Their cusps are sharp, the paraconid equalling the hypoconid in vertical height. The protoconid is higher than the metaconid, which it nearly hides in side view, though its summit is a very little posterior to that of the metaconid. The entoconid and the hypoconid are of equal height, the former very slightly anterior to the latter in side view (Plate, fig. 14). There seems to be also a minute hypoconulid. The condyle of the jaw is not in condition for thorough comparison.

*Measurements.*—Front of  $pm_4$  to ascending process of mandible, 7.5 mm.; front of  $pm_4$  to back of  $m_2$ , 5.5; length of  $m_1$ , 2.3; of  $m_2$ , 2.0; depth of ramus at front of  $m_2$ , 2.4.

*Specimen examined.*—The type.

*Remarks.*—While agreeing in the general structure of the teeth so far as this can be determined from the specimen, there are such evident differences of proportion and size as to render it unlikely that this jaw is from a species of *Nesophontes*. Nevertheless the similarity is sufficient to associate it with that genus until better material may be discovered to prove its relationships are otherwise. Certainly the present fragment is insufficient for the founding of still another genus. The teeth are of a rather primitive type and clearly indicate a fourth species of Antillean insectivore.

## RODENTIA.

### BOROMYS TORREI, sp. nov.

Plate, fig. 10-13.

*Type.*—A palate with root of right zygomatic arch,  $pm^4$  and alveolar row of right side,  $m^1$  and posterior part of alveolar row of left side, M. C. Z. 9601. From a cavern in the Sierra of Hato-Nuevo, Province of Matanzas, Cuba. Carlos de la Torre.

*Description.*—Resembles *Brotomys voratus* of San Domingo and *Boromys offella* of Cuba, but differs from both in its much smaller size and the deeper indentation of the posterior emargination of the palate, which reaches forward to the level of the center of  $m^2$ . It is not possible to determine whether there is a supplemental groove at the base of the antorbital foramen, the chief cranial character distin-

guishing *Boromys* from *Brotomys*. In the tooth pattern, however, the type specimen seems to correspond more nearly to the description of *Boromys*, to which I shall provisionally refer it.

The essential feature of the molars in both genera is probably the same, though *Boromys*, so far as at present known, seems to have deeper anterior secondary folds of the enamel. The upper molars have each a deep median enamel fold on the inner and the outer side, that meet at the middle of the tooth. The anterior half has another fold from the exterior, which though extending a trifle beyond the median line of the tooth, is of less vertical extent than the primary fold. The posterior half has a similar secondary fold extending inward from the palatal side of the tooth. As Miller points out, the posterior secondary fold is smaller than the anterior, so that the minute enamel lake to which it eventually is reduced by wear, disappears before the anterior lake, a condition which appears to obtain in the type here described. In this specimen the second molariform tooth,  $m^1$ , is more worn than the first,  $pm^4$ , so that it has a large lake of enamel in its anterior half and a smaller round one in its posterior, whereas  $pm^4$  has the anterior secondary fold still strongly connected with the external enamel wall, while the posterior secondary fold is reduced to a small round dot. Both these upper teeth are slightly everted. In the empty alveoli, the cavities of three roots are seen, two anterior, and a third posterior occupying the breadth of the cavity. The anterior edge of  $pm^4$  is on a level with the posterior edge of the zygomatic root.

In addition to the type palate, several lower jaws were found, which though dissociated, unquestionably belong to this species. All are of uniform size. The lower incisor is strong, its base curving back and out, to end slightly above and external to the alveolar row of the molars. Its anterior enamel face is orange-yellow in color, in contrast to the very shining white of the molars. As in the upper molars the outer median enamel fold (Plate, fig. 11) has its tip very slightly posterior to that of the inner fold. A minute round enamel lake is present in both anterior and posterior halves of the first tooth,  $pm_4$ , but in the posterior half only of the two succeeding teeth,  $m_1$  and  $m_2$ . In this respect the lower molars differ from those of *Steiromys*, which has a secondary reentrant in the anterior lobe of the molars. None of the specimens shows  $m_3$  in place. Two isolated teeth, evidently lower molars, show clearly that there is no secondary reentrant in the anterior half, but that it is present in the posterior half only (Plate fig. 12).

*Measurements.*—Alveolar length of upper tooth row, 7.6 mm.; width of alveolus of  $m^1$ , 2.1; width of palate outside alveoli of  $m^1$ , 6.4; width of palate outside alveoli of  $m^2$ , 6.5; length of crown of  $pm^4$ , 2.0; of  $m^1$ , 1.9; width between alveoli of  $m^2$  (front corners), 2.1; lower jaw, diastema, 4.1; alveolar length of lower tooth row, 7.0; length of  $pm_4$ , 2.0; of  $m_1$ , 1.7; of  $m_2$ , 1.7.

*Specimens examined.*—The type palate, eight lower jaws, and two separate lower molars.

*Remarks.*—Notwithstanding the similarity in general structure of the enamel pattern, it is unlikely that this small species will prove to be a member either of *Brotomys* or *Boromys*, if indeed the two latter are really as distinct as supposed. The structure of the palate is different in the present form and this coupled with its much less size presupposes further important differences. Until better material is available, however, it may stand provisionally with *Boromys*. The pattern of the upper molars, as Miller (1916a) remarks is not very different from that of *Stichomys* and it might be added, of *Asteromys*.

It is a pleasure to associate with this interesting discovery, the name of Professor de la Torre, whose investigations have so greatly enriched our knowledge of the natural history of Cuba.

The second species of rodent discovered, belongs to the group of short-tailed *Capromys*-like animals, a group to which I here assign generic rank. It may be defined as follows.

#### *GEOCAPROMYS* Chapman (1901, p. 314).

*Type Species.*—By selection, *Capromys brownii* Fischer.

*Generic Characters.*—Like *Capromys*, but the tail little, if any longer than the hind foot with claws; the thumb much more reduced so as to be scarcely evident. The most important cranial character is the presence of an additional antero-internal enamel fold in the first lower cheek-tooth, making three evident reentrants on the lingual side, instead of two, as in *Capromys*, a character which in view of the relatively small amount of variation in the enamel pattern of the two genera, assumes here considerable importance (Plate, fig. 1-6, 8). In addition, the upper tooth rows are more strongly convergent anteriorly and the zygomatic portion of the maxillary is broader than in *Capromys*.

Three living species are included in this genus. Of these, *Geocapromys brownii*, of Jamaica, is the largest. The two others, *G. thorac-*



*tus* of Little Swan Island, and *G. ingrahami* of Plana Keys, Bahamas, are smaller, and much more resemble each other in their gray type of coloring than they do the large dark brown animal of Jamaica. As Chapman pointed out, these may indicate two species-groups. The recent discovery in Jamaica of fossil jaws indistinguishable from those of *G. thoracatus* (Miller, 1916) may further indicate that both species-groups formerly were represented in that island. An additional character of value is the color of the incisors. These are deep yellow in adults of all species of *Capromys*. In *Geocapromys brownii* and *ingrahami* they are very pale yellow, almost whitish; while in *G. thoracatus* and the new fossil species described below from Cuba, the incisors are ivory-white. The Cuban species may be known as

*GEOCAPROMYS CUBANUS*, sp. nov.

Plate, fig. 7-9.

*Type*.—Portion of the right lower ramus of an immature animal, showing the incisor and three anterior cheek-teeth in place, M. C. Z. 9602. From the Sierra of Hato-Nuevo, Province of Matanzas, Cuba. Carlos de la Torre.

*Description*.—A species slightly smaller than *G. ingrahami*, but with relatively broader molars, when adult. The reentrants are relatively deeper, narrower, and more nearly parallel-sided, giving the pattern an appearance of greater compression in the direction of the jaw's axis. The anteriormost inner reentrant of  $pm_4$  is relatively deeper than in any of the existing species, and reaches to the mid-line of the tooth (Plate, fig. 8). The incisors are slender and white. The palate (M. C. Z. 9603) shows the strongly contracted tooth rows and narrow median bony ridge characteristic of the genus. The broken condition of the palates discloses the fact that the alveoli of the upper molar rows, though 2 mm. apart at the point where the teeth emerge, are nearly in contact at the upper level of their roots, as if foreshadowing the condition in *Synodontomys* in which the tooth rows are practically in contact at the level of the palate.

The enamel pattern of adult specimens more nearly resembles that of *G. brownii* of Jamaica than it does either of the other living species. Young individuals have a more open pattern showing less compression and depth of the enamel folds, but intermediate conditions link these extremes in the series at hand. The palate ends at about the

level of the middle of  $m^2$ , without the median bony projection found in *G. thoracatus*.

*Measurements*.—Length of lower diastema of type, 7 mm.; of  $pm_4$ , 3.1; of  $m_1$ , 3; length of lower molar row in an adult, (9604), 14.3; of  $pm_4$ , 4; of  $m_1$ , 3.5; of  $m_2$ , 3.0; width of  $m_1$ , in same specimen, 3.7; length of upper molar row (9603), 13.2; distance between tooth rows anteriorly, 1.8; posteriorly, 5.6; width across anterior corners of alveoli of cheek teeth, 7; width of  $m^1$ , 3.6.

*Specimens examined*.—Five palates with teeth, about 15 jaw fragments mostly with teeth, and numerous other fragments.

*Remarks*.—The relationship of the fossil Cuban *Geocapromys*, seems on the whole to be with *G. brownii* in the relatively broad molars with their deep, compressed enamel folds. It is nearer *G. ingrahami* in size, though even smaller; and further resembles that species in the form of the terminal part of the bony palate, which is arched and lacks the distinct median projection seen in *G. thoracatus*. The remains of this extinct Cuban species compose most of the original block of bone-breccia which forms the subject of this paper. The bones are so greatly broken, however, that it was impossible to extricate any except the dental portions of the skull and a few ear bullae.

#### GENERAL REMARKS.

While it is premature to speculate on the significance of the recently discovered fossil mammals in Cuba, Porto Rico, and San Domingo, it is clear that the additional facts of distribution tend to confirm the evidence for a former continuity of the Greater Antillean land masses. Thus *Geocapromys* is now known from Little Swan Island, Jamaica, Cuba, and Plana Keys, with probably two types in Jamaica. A Cuban insectivore related to the fossil *Nesophontes* of Porto Rico parallels the presence of *Solenodon* on Cuba and San Domingo. The *Isolobodon* of Porto Rico is indistinguishable from that of San Domingo. Related genera of rodents — *Brotomys* and *Boromys* — are found to occur in San Domingo and Cuba respectively. These, and other cases among reptiles (Barbour, 1914), birds, and mammals seem to imply a consistent rather than a haphazard method of distribution, the most obvious explanation of which seems to be that the Antillean land mass was formerly of larger extent and that the several islands now representing it were once connected. The dismemberment of

this hypothetical land mass into islands, whether by depression, by the erosion of ocean currents, or by other geological processes, has separated members of a once more homogeneous fauna, and through long isolation they have in many cases developed racial variations on the different islands.

The time is not ripe for conclusions as to the place and method of origin of the West Indian fauna. The evidence of fossil mammals is still inconclusive. For while the numerous species and genera of sloths and hystricine rodents recall strongly the characteristic South American forms, the hystricines are of wide distribution in both hemispheres, and insectivores are, so far as known, wholly absent from South America until very recent times. Nevertheless the more obvious view seems to be that the mammal fauna reached these areas at a rather remote time, perhaps in part as more primitive types in a retreat before a fauna of more specialized invaders from a northern center of distribution, as argued so ably by Matthew (1915). A severance of land connections with the continent would be then postulated, so that the ancient fauna might survive apart from further competition with more modern forms.

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**EXPLANATION OF THE PLATE.**

# EXPLANATION OF THE PLATE.

(All figures drawn with camera lucida).

Figs. 1-3.— First lower cheek-tooth ( $pm_1$ ) of *Capromys*, right side.

Fig. 1.— *Capromys prehensilis*.  $\times 5$ .

Fig. 2.— *C. pilorides*.  $\times 5$ .

Fig. 3.— *C. melanurus*.  $\times 5$ .

Figs. 4-6, 8. First lower cheek-tooth ( $pm_1$ ) of *Geocapromys*, right side.

Fig. 4.— *Geocapromys brownii*.  $\times 5$ .

Fig. 5.— *G. thoracatus*.  $\times 5$ .

Fig. 6.— *G. ingrahami*.  $\times 5$ .

Fig. 8.— *G. cubanus* (immature), from the type.  $\times 6.1$ .

Fig. 7.— Upper cheek-teeth of *Geocapromys cubanus*, to show enamel pattern.  
 $\times 5$ .

Fig. 9.— Lower molars ( $m_{1-2}$ ) of an adult *G. cubanus*.  $\times 5+$ .

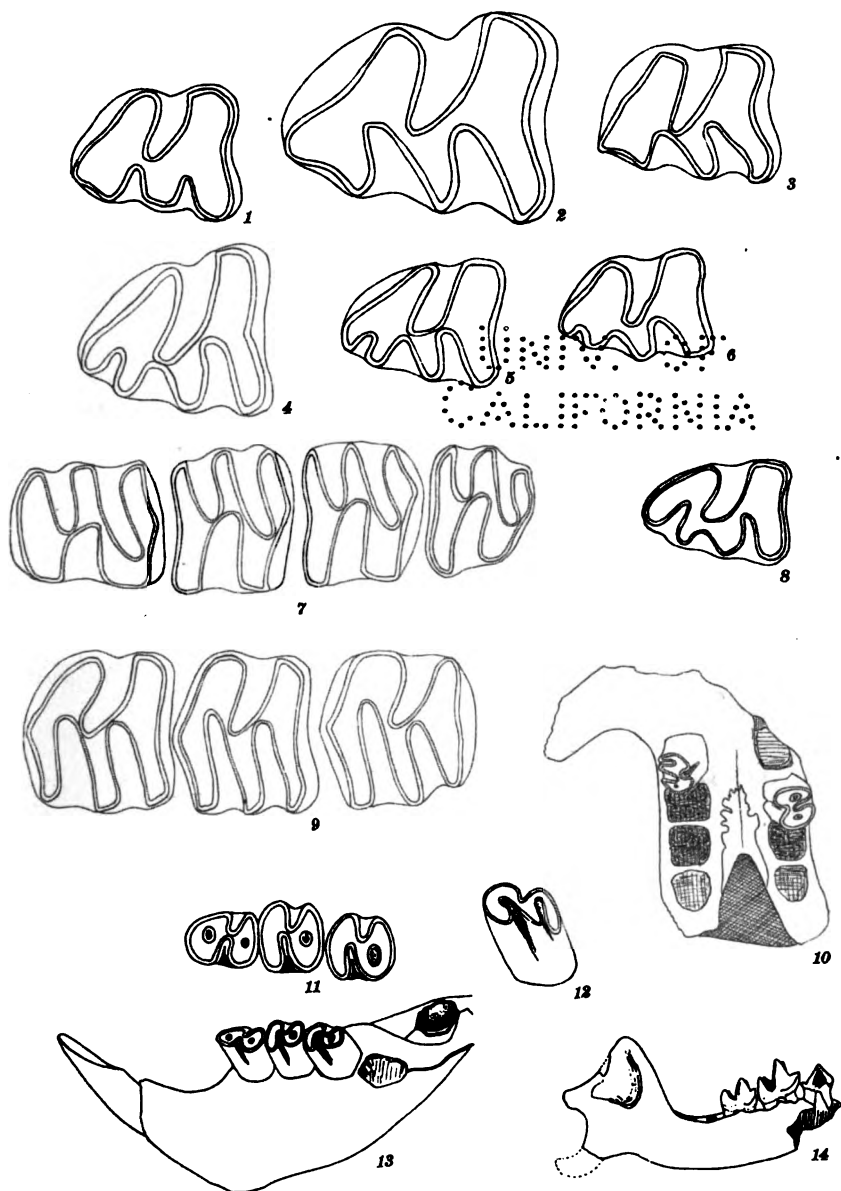
Fig. 10.— *Boromys torrei*, from the type, showing the form of the palate, the right upper premolar ( $pm^1$ ) and left upper first molar ( $m^1$ ).  $\times 3.5$ .

Fig. 11.— Enamel pattern of the crowns of the three anterior cheek-teeth, lower jaw, of *Boromys torrei*.  $\times 5$ .

Fig. 12.— A lower molar of *Boromys torrei*, less worn than those in the preceding figure, showing the shallow secondary reentrant.  $\times 5$ .

Fig. 13.— Fragment of right lower jaw of *Boromys torrei*.  $\times 3$ .

Fig. 14.— Portion of right lower jaw of ?*Nesophontes micrus*, showing  $pm_1$ ,  $m_1$ ,  $m_2$ , in place and roots of  $m_1$ . From the type.  $\times 2.7$ .



REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUTENANT COMMANDER L. M. GARRETT, U. S. N., COMMANDING, PUBLISHED OR IN PREPARATION:—

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| <p>A. AGASSIZ. V.<sup>1</sup> General Report on the Expedition.</p> <p>A. AGASSIZ. I.<sup>1</sup> Three Letters to Geo. M. Bowers, U. S. Fish Com.</p> <p>H. B. BIGELOW. XVI.<sup>18</sup> The Medusae.</p> <p>H. B. BIGELOW. XXIII.<sup>22</sup> The Siphonophores.</p> <p>H. B. BIGELOW. XXVI.<sup>23</sup> The Ctenophores.</p> <p>R. P. BIGELOW. The Stomatopoda.</p> <p>O. CARLGREN. The Actinaria.</p> <p>R. V. CHAMBERLIN. XXXI.<sup>31</sup> The Annelids.</p> <p>H. L. CLARK. The Holothurians.</p> <p>H. L. CLARK. The Starfishes.</p> <p>H. L. CLARK. XXX.<sup>30</sup> The Ophiurans.</p> <p>S. F. CLARKE. VIII.<sup>8</sup> The Hydroids.</p> <p>W. R. COE. The Nemerteans.</p> <p>L. J. COLE. XIX.<sup>19</sup> The Pycnogonida.</p> <p>W. H. DALL. XIV.<sup>14</sup> The Mollusks.</p> <p>C. R. EASTMAN. VII.<sup>7</sup> The Sharks' Teeth.</p> <p>S. GARMAN. XII.<sup>12</sup> The Reptiles.</p> <p>H. J. HANSEN. The Cirripeds.</p> <p>H. J. HANSEN. XXVII.<sup>27</sup> The Schizopoda.</p> <p>W. E. HOYLE. The Cephalopoda.</p> <p>W. C. KENDALL and L. RADCLIFFE. XXV.<sup>25</sup> The Fishes.</p> <p>C. A. KOFOID. III.<sup>3</sup> IX.<sup>9</sup> XX.<sup>20</sup> The Protozoa.</p> | <p>C. A. KOFOID and J. R. MICHENER. XXII.<sup>22</sup> The Protozoa.</p> <p>C. A. KOFOID and E. J. RIGDEN. XXIV.<sup>24</sup> The Protozoa.</p> <p>P. KRUMBACH. The Sagittae.</p> <p>R. VON LENDENFELD. XXI.<sup>21</sup> The Siliceous Sponges.</p> <p>R. VON LENDENFELD. XXIX.<sup>29</sup> Hexactinellida.</p> <p>G. W. MÜLLER. The Ostracoda.</p> <p>JOHN MURRAY and G. V. LEE. XVII.<sup>17</sup> The Bottom Specimens.</p> <p>MARY J. RATHBUN. X.<sup>10</sup> The Crustacea Decapoda.</p> <p>HARRIET RICHARDSON. II.<sup>2</sup> The Isopods.</p> <p>W. E. RITTER. IV.<sup>4</sup> The Tunicates.</p> <p>G. O. SARS. The Copypoda.</p> <p>F. E. SCHULZE. XI.<sup>11</sup> The Xenophyphoras.</p> <p>HARRIET R. SEARLE. XXVIII.<sup>28</sup> Isopoda.</p> <p>H. R. SIMROTH. Pteropoda, Heteropoda.</p> <p>E. C. STARKS. XIII.<sup>13</sup> Atelaxia.</p> <p>TH. STUDER. The Alcyonaria.</p> <p>JH. THIELE. XV.<sup>15</sup> Bathysciadina.</p> <p>T. W. VAUGHAN. VI.<sup>6</sup> The Corals.</p> <p>R. WOLTERECK. XVIII.<sup>18</sup> The Amphipoda.</p> |
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- <sup>2</sup> Bull. M. C. Z., Vol. XLVI., No. 6, July, 1905, 4 pp., 1 pl.
- <sup>3</sup> Bull. M. C. Z., Vol. XLVI., No. 9, September, 1905, 5 pp., 1 pl.
- <sup>4</sup> Bull. M. C. Z., Vol. XLVI., No. 14, January, 1906, 22 pp., 3 pls.
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- <sup>6</sup> Bull. M. C. Z., Vol. L., No. 3, August, 1906, 14 pp., 10 pls.
- <sup>7</sup> Bull. M. C. Z., Vol. L., No. 4, November, 1906, 26 pp., 4 pls.
- <sup>8</sup> Mem. M. C. Z., Vol. XXXV., No. 1, February, 1907, 20 pp., 15 pls.
- <sup>9</sup> Bull. M. C. Z., Vol. L., No. 6, February, 1907, 48 pp., 18 pls.
- <sup>10</sup> Mem. M. C. Z., Vol. XXXV., No. 2, August, 1907, 56 pp., 9 pls.
- <sup>11</sup> Bull. M. C. Z., Vol. LI., No. 6, November, 1907, 22 pp., 1 pl.
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- <sup>14</sup> Bull. M. C. Z., Vol. XLIII., No. 6, October, 1908, 285 pp., 22 pls.
- <sup>15</sup> Bull. M. C. Z., Vol. LII., No. 5, October, 1908, 11 pp., 2 pls.
- <sup>16</sup> Mem. M. C. Z., Vol. XXXVII., February, 1909, 243 pp., 48 pls.
- <sup>17</sup> Mem. M. C. Z., Vol. XXXVII., No. 1, June, 1909, 172 pp., 5 pls., 3 maps.
- <sup>18</sup> Bull. M. C. Z., Vol. LII., No. 3, June, 1909, 26 pp., 8 pls.
- <sup>19</sup> Bull. M. C. Z., Vol. LII., No. 11, August, 1909, 10 pp., 3 pls.
- <sup>20</sup> Bull. M. C. Z., Vol. LII., No. 13, September, 1909, 48 pp., 4 pls.
- <sup>21</sup> Mem. M. C. Z., Vol. XLII., August, September, 1910, 323 pp., 56 pls.
- <sup>22</sup> Bull. M. C. Z., Vol. LIV., No. 7, August, 1911, 38 pp.
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**DOGS OF THE AMERICAN ABORIGINES.**

**BY GLOVER M. ALLEN.**

**WITH TWELVE PLATES.**

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No. 9.— *Dogs of the American Aborigines.*

BY GLOVER M. ALLEN.

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INTRODUCTION.

WHEN Columbus, in 1492, made his discovery of land in the Western Hemisphere, he found it already peopled by a race of men who are considered by modern ethnologists to be of Asiatic origin, and probably of an antiquity dating back not many thousands of years. Yet these aboriginal peoples were considerably diversified as to appearance, language, and customs. In South America, the Incas had domesticated animals, llamas and alpacas, whose wild progenitors are the last

remnant of the once diverse phylum of American camels. There is no good evidence, however, that the horse which survived in North America till late Pleistocene times was ever known to the aborigines until its reintroduction by Europeans. Dogs they had, nevertheless, universally and in some variety. Yet at this late date it is hardly possible to define the various breeds or variations with any exactness or to throw much light on the question of their ultimate origin. An attempt is made here to gather what information the earlier travellers recorded as to the appearance of the dogs of the American aborigines, and so far as may be, to characterize the various breeds that can be distinguished.

A bibliography is added giving the more important papers on the origin of the dog, and on prehistoric dogs of the Old World, as well as references to the aboriginal dogs of America.

#### ACKNOWLEDGEMENTS.

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For interesting photographs of dogs, thanks are gratefully extended to Messrs. Ernest Harold Baynes, W. B. Cabot, C. T. Currelly, W. C. Farrabee, S. J. Guernsey, the Royal Ontario Museum of Archaeology, and the American Genetic Association.

#### ORIGIN OF THE DOMESTIC DOG.

The problem of discovering the wild ancestor of the Domestic Dog has engrossed the attention of naturalists from the time of Buffon to the present. Basing their opinion on general external resemblances, the early systematists, Gldenstadt and Pallas, favored the Indian Jackal as the primitive stock whence the European dogs were derived. In this course they have been followed by many later writers, but more exact studies (Miller, 1912) show that the teeth of the Jackal may be

distinguished by many minor characters (such as the broadly continuous outer cingulum on  $m^2$  and  $m^3$ ) from those of the Wolf and Dog. Gidley (1913) has illustrated more fully some of the distinguishing tooth-characters of several canids, including fox, wolf, and coyote, and has grouped them into a key, from which it is seen that domestic dogs and wolves are essentially alike in the cusp-characters and proportions of their teeth, and differ from coyotes and foxes in average characters which though slight, are appreciable on direct comparison. Miller (1912, p. 313) concludes that in a series of dog-skulls "representing such different breeds as the pug, fox-terrier, bloodhound, mastiff, ancient Egyptian, ancient Peruvian, Eskimo (Greenland and Alaska) and American Indian, the teeth are strictly of the wolf type"; and this assertion I can fully endorse from a study of these and other breeds. Nevertheless, though the Wolf and the Domestic Dog are closely related, it does not follow that the latter is directly derived from the former, though even as lately as 1911, Trouessart has upheld the view first put forth by Jeitteles (1877), that the Indian Wolf (*Canis pallipes*) might be the ultimate source of certain breeds of the Dog. Studer (1906) suggests some large Dingo-like type as the lost ancestor; while Noack (1907) supposes that the original stock may have been identical with a small Chinese Wolf of which he possessed two specimens from Tchili, regarded as like the Dingo in color. Nehring (1887) suggests that a small Japanese Wolf (*C. japonicus*) is the living ancestor of the Japanese Street-dog. The Dingo itself is of doubtful origin, and though probably a relatively recent arrival in Australia, may have been brought at the time the Continent was first peopled by man. Krefft (1866) believes he has identified its "first molar tooth . . . with other fossil remains in the breccia of the Wellington caves," while McCoy (1862) has "identified its bones mingled with those of recent and extinct animals all in one state of preservation in the bone-caverns recently opened beneath the basalt flows at Mount Macedon." In New Zealand, domestic dog-remains of a different breed are found associated with those of the extinct giant rails in the kitchen-middens and presumably came with the Maoris (Hutton, 1898).

The older naturalists maintained the view that cross fertility was a test of specific identity, and recorded many cases in support of the contention that the Dog was fertile with Wolf and Jackal, and that hence it was of such mixed ancestry. Thus, Hunter (1787) recorded the fertile cross between a male Dog and a female of the Wolf and of the Jackal, whence he concluded that all were of one species. A more

recent investigator, (Kühn, 1887) records the fertility of Dog-Jackal hybrids when crossed *inter se* or back crossed. In this case a female Finnish Bird-dog was bred to a captive Indian Jackal (*Canis aureus indicus*), producing three litters of four each. All the young were much alike in appearance resembling the Jackal, but were somewhat darker in color. One of the hybrids bred to a Siberian Dog produced seven young. Two other of the original hybrids were paired together, and produced a litter of three young after a period of sixty days' gestation — the normal time for a dog. These young were darker than their parents, with a wash of gold on along the sides and on the head, recalling the Jackal's color. Unfortunately no careful study of the cranial and dental characters in the hybrids was made.

The crossing of Wolf and Dog has been frequently accomplished in captivity (Hunter, 1787, 1789). An instance of the fertile crossing of a Siberian Sledge-dog with a female Dingo from Australia is recorded by Eiffe (1909). The North American Indians and the Eskimo are accredited with tethering female dogs in heat at a distance from camps to obtain crosses with wild wolves, which though usually highly hostile to dogs, will at such times, it is said, hybridize. According to Coues (1873) and others, similar methods were used by the American Indians of the Plains to obtain crosses with wild coyotes. Yet the evidence is not altogether convincing that such cross-breeding was very general, or that it has modified the native dogs in any way. It is noteworthy that the American Indian is not given to the domestication of Wolf or Coyote puppies as might be expected if either were the prototype of his Dogs. Nevertheless Coues (1873) and Packard (1885) on the ground of general external appearance have held that the common Indian Dog of North America was merely a tamed Coyote; and their view has gained wide credence. It may be confidently stated, however, from a study of skulls and teeth, that this is not at all the case. Packard was perhaps influenced by Cope's (1883, p. 242) statement that "many of the domesticated dogs have been derived" from the Wolf and the Coyote, as found in the Pliocene deposits of the Republican River formations. The American Indian dogs, however, are true domestic dogs in skull-characters, and show no evidence of derivation from coyotes.

Crosses between domestic dogs and foxes have been less commonly reported, and even these reports seem to lack proper substantiation in most cases. B. Ross (1861) explicitly states that the dogs of the northern Indians could not be induced to cross with captive foxes. A supposed case is given by Toni (1897) of a natural hybrid, but its ancestry as in one or two other cases, was merely conjectural.

While some naturalists have thus sought to derive the Domestic Dog from Wolf, Jackal, Coyote, or Fox, or from a mixture of two or three of these, others have maintained that it is quite as well entitled to be considered a distinct species with its various artificial breeds. Buffon was one of the first to support this view. Pictet (1853, 1, p. 203-210) believed that dog-remains from cave-deposits in Europe probably represented the wild ancestor of domestic dogs, and to this wild species he gave the name *Canis familiaris fossilis*. In this he was followed by Bourguignat (1875) who regarded the Prehistoric Dog as a species, related to the Wolf but coexistent with it in a wild state. He applied to it the name *Canis ferus*, and concluded from the relative scarcity of its remains in the earlier strata of human culture, that it was at first seldom domesticated by the early cave-men. Remains of Pliocene canids from central France have been suggested by Boule (1889) as representing the progenitors of the Domestic Dog.

Although the recent and more exact studies of Miller (1912, p. 313) and Gidley (1913, p. 99) have shown that the Domestic Dog may be distinguished by dental characters from Coyote, Jackal, and Fox, its close relationship to the wolves is shown, as they point out, by the shorter and narrower heel of the lower carnassial in proportion to the length and width of the remaining part, the general bluntness and plumpness of the premolar and molar teeth and their cusps, as well as by the shorter and blunter canines. Other less constant but average distinctions are tabulated by the latter author. A noticeable character of the lower tooth-row in Wolf and Dog may also be mentioned, namely, its distinctly outward bend at the junction of the molar and premolar series, whereas in the Coyote and the Jackal, the axis of the tooth-row is much more nearly a straight line. The presence of a minute second posterior cusp in addition to the cingulum in the fourth lower premolar is characteristic of Jackal and Coyote.

The relationship of the Domestic Dog having thus been found to be wholly with the Wolf, and not with Jackal, or Coyote, it remains for future investigation to show what wolf-like ancestor was its wild progenitor. This, however, lies outside the scope of the present paper. Yet it may be said that no evidence has hitherto been adduced that clearly indicates the origin of the Dog from any of the large wolves of circumboreal distribution. In general the skull of the Dog is at once distinguished from that of the Wolf, apart from its usually smaller size, by the higher forehead of the former. That this, however, is due to greater development of the cerebrum through domestication has been suggested by Hammeran (1895), notwith-

standing that domestication in case of most animals seems rather to have a stultifying effect. A more diagnostic character is found in the size of the teeth, which even in the largest breeds of dogs are considerably smaller than in the wolves. A fact of probable significance is that in wolves as in the less modified breeds of dogs, *e. g.*, the American Indian dogs, the free posterior border of the palate ends about on a line passing transversely through the middle of the last molar. In the large breeds of European dogs a transverse line at the hinder margin of the palate usually falls considerably behind the last molar, indicating probably that the teeth have retained more nearly their original size relations than have the maxillary and other bones. A like condition is seen also in dogs in which the teeth are abnormally reduced in size, due probably, as in case of the Chinese Chow Dog, to a diet of soft foods as rice and fish through many generations. These facts tend to indicate that the Dog and the large Wolf are really distinct species, and that the wild progenitor of the Dog was a small Wolf of a species distinct from the large wolves of circumboreal distribution. It is natural to look to Asia for this unknown ancestor, and it would be valuable if the studies of Noack and Nehring as to the small wolves of Tchili and Japan might be more fully confirmed. Jentink (1897) suggests the Wild Dog of Java as a representative of the original stock whence the Domestic Dog sprang.

Attention should here be called to the possible effect of domestication in reducing the size and proportions of the Wolf. Apparently the only investigator to compare the skulls of wolves born in captivity with those of wild individuals is Wolfgramm (1894), who states that the skulls of the captive-born wolves are smaller in all proportions, broader and higher, with less developed muscle-crests. The snout is so shortened that  $pm^4$  is forced to assume a transverse position, the lower premolars are imbricate, while in size the carnassial as well as the other teeth are said to be slightly reduced. Wolfgramm concludes that this is sufficient proof that the Dog is derived from the European Wolf, and that its smaller size is a direct result of its domestication. The facts, however, do not warrant such a conclusion. The reduced size of the skull and the crowding of the teeth in captive-born wolves are probably a result of improper nutrition during growth and lack of exercise under confinement, conditions wholly different from the free life of a dog under domestication. The crowding of the premolars is quite as abnormal for a dog as for a wolf, and occurs through failure of the maxillary bones to attain their proper growth, while the teeth themselves attain their size independently.



While some authors have considered that modern dogs are polyphyletic, and would trace the ancestry of the larger breeds to wolves and of the smaller to foxes (Woldrich, 1886a, even suggests the Fennec!), it seems more reasonable to derive them all from a medium-sized dog through selective breeding. Nevertheless it is possible to divide modern breeds into some four to six groups, based mainly on size and minor external characters as erect or lop-ears, drooping or curled-up tail, etc. Cuvier (1808) believed that the French Sheep-dog approached the wild prototype most nearly of all domestic breeds, and considered the Australian Dingo as the most primitive true dog. The characters considered primitive are chiefly the medium size, the erect, wolf-like ears, unshortened snout, drooping and moderately haired tail, and low forehead. The ability to bark is often considered an acquired trait; and the more primitive dogs, such as the Eskimo, howl like wolves more than they bark.

Historic evidence as to the ancestry of the Dog does not carry the matter far enough. The Egyptians had dogs as far back as the records go — certainly four to five thousand years before the Christian era. The same is apparently true of the Chinese, whose history goes back nearly as far. Lortet and Gaillard (1909) recognize four breeds of dogs among the mummified remains from Assiout. Fitzinger (1866) has summarized the ancient history of dogs known from the earliest writings of Rome, Greece, Assyria, and Egypt. Yet it is clear that at the dawn of history, the nations of Europe, Asia, and North Africa had dogs of several breeds, more or less characteristic of each people. Thus the Greyhound type seems especially prevalent in Egypt and is to this day associated with the desert-loving races of Persia and northern Africa.

European archaeologists have made many discoveries of dog-remains in association with bones and implements of prehistoric man, particularly in the caves and old Lake-dwellings of southern Europe. Hitherto at least eleven different Latin names have been applied to as many supposedly distinct prehistoric dogs of Europe. Anutschin (1881) announced the discovery of the first dog-remains to be found in Russia. Parts of fourteen dog-skeletons were found in building the Ladoga Canal, and represent two types which he names respectively *Canis familiaris palustris ladogensis*, and *C. f. inostranzewii*. He considers these to be of the Stone Age, and that the former is closely allied to the Siberian and Northwest American Sledge-dogs — (Eskimo). The latter he thinks very similar to the *C. matris-optimae*, a deerhound-like type, from the Bronze Age, or even earlier (Neolithic,

according to Nehring, 1883). Dog-remains, associated with a human skeleton and palaeolithic implements, were described by Studer (1906) as *Canis poutiatini*, and were discovered while digging a street near Gute Bologoie in Russia. This was as large as a medium-sized Sheep-dog and is believed by this author to be the fore-runner of *C. intermedius* of the Bronze Age, which is possibly a hound.

In the Swiss Lake-dwellings occur skulls of a smaller type of dog named by Rüttimeyer *Canis palustris*, a breed characteristic of the later Neolithic and the Bronze Ages, in Europe, 5,000 to 7,000 years ago. Another Neolithic Dog of small size (skull length, 158 mm.) is described by Hué (1906) from Clairvaux, Jura, as *Canis le mirei*, while still another of dwarf proportions, *C. mikii*, is considered by Studer (1906) as a fore-runner of *C. palustris*. The same author (Studer, 1901) sees much resemblance between skulls of *C. palustris* and those of Chow and Spitz. Undoubtedly the Chow is a rather ancient type, in many ways recalling the Eskimo Dog in its erect short ears, broad muzzle, small eyes, bushy mane, and curled-up tail carried stiffly over the hip. Measurements of skulls of Chows given by Studer are slightly larger than those of *C. palustris*.

No less than four breeds of dogs are recognized by Strobel (1880) in human culture layers transitional from the Neolithic to the Bronze Age in Emilia, Italy. One is the small *C. palustris* wide-spread in the Stone Age of Europe; the second is *C. intermedius*, a larger dog supposed to be a hound; the third is the larger *C. matris-optimae*, regarded by Studer (1901) as of the Collie and Sheep-dog (Wolf-dog) type, while the fourth is a Dog smaller than *palustris*, and believed to be of a distinct breed which Strobel names *C. spaletti*. Remains of the first three of these breeds are recognized by Woldrich (1898) from culture layers of middle Neolithic times in caverns of Bohemia.

From these brief accounts of discoveries of prehistoric dogs it is clear that at a very early period of human culture there were at least two or three types under domestication in Europe. It need not be supposed, as some authors have done, that these types are of local origin. Europe, as a peninsula of Asia, probably received its dogs as well as its human population in part at least from the East. Possibly then, as now, certain breeds of dogs were characteristic of different invading tribes.

## ORIGIN OF AMERICAN DOGS.

Very little attention has been paid to the dogs of the American Aborigines. At the present day it is probably too late to find pure-bred examples of most of the local varieties that formerly occurred. Barton (1805) was about the only American naturalist to give much thought to the matter, but the few notes he collected were taken mostly at second-hand and were rather indefinite. Coues, Cope, and Packard, as well as many writers following them, considered that the domestic dogs of America must have been derived from the Coyote, or from some other indigenous species of North or South America. Cope was the only one who made an examination of the teeth. In a fragment of a lower jaw from Florida, Cope (1893) made particular note of the absence of the first premolar and remarked on the large size of the metaconid and the entoconid of the lower carnassial. It is true that in a large percentage of American native dogs the first premolar is absent from the lower jaw. A similar anomaly is occasionally seen in wolves and in European dogs, but is rare. It is usually considered that the first premolar in dogs is without a milk predecessor, but though this is often true, it is not always the case. A jaw of a very young dog in the Museum collection, shows very small milk-teeth capping the permanent first premolars which are nearly erupted. A similar case is reported by Lataste (1888). The entire suppression of the first premolar, particularly in the lower jaw, in a large percentage of American dogs, is possibly a retention of the usual early condition, in which there is no first milk premolar.

The important paper of Loomis and Young (1912) and the reports of Nehring on dogs from ancient Peruvian burials comprise most of the work that has been done in the comparative dental and osteological study of American dogs. There are, however, brief notices of the discovery of prehistoric dog-remains and early accounts of certain native dogs by travellers, the more important of which are included in the Bibliography (p. 504-517). Miller (1912) seems to have been the first to show that the teeth of American aboriginal dogs are those of true dogs rather than of coyotes or wolves. This I have verified from a considerable mass of material from North America and Peru, so that there can be no question but that the domestic dogs of both Old and New Worlds are closely related and of common ancestry. It follows that instead of having domesticated various dog- or fox-like species of the American continents, the peoples of the New World

must have brought their dogs with them, presumably from Asia, and this probably at a culture stage prior to the domestication of other animals, at least in the North, since no other domestic animal is common to the peoples of both hemispheres. The Asiatic origin of American dogs has previously been suggested by Mercer (1897, p. 126) and Wissler (1917).

The probability therefore is, that the Domestic Dog originated in Asia and was carried by primitive man both east and west into all parts of the inhabited world. That this migration began in late Pleistocene times seems highly probable.

In the Western Hemisphere three types of dogs may in a very general way be distinguished:— (1) the large wolf-like Eskimo Dog of the Arctic countries, strong, powerfully built, with broad muzzle, erect ears, and large bushy tail curled forward over the hip; (2) a smaller type, varying more or less in size and proportions, with erect ears but a drooping tail; and (3) a much smaller type, the size of a terrier, heavy of bone, usually with shortened rostrum as seen among the tribes of the Southwest or again, apparently more slender both in limb and skull as in southern Mexico or parts of South America. South of the Eskimo country, the two latter types of dogs are characteristic, and seem to have occurred together over much of their range, so that travellers often mentioned a "wolf-like" and a "fox-like" dog among the Indians of both North and South America. In this connection, it is interesting to recall Köhler's (1896) statement that in eastern Asia, between the provinces of Gansing and Ussuri, the Chinese have small fox-like dogs, a comparison of which with the small American dogs would be of interest. The smaller American dogs of the slender type (Techichi) seem not very different from the Old World *C. palustris*, and may be not remotely related. The more heavily built small dogs with shortened faces and shorter, stouter limb-bones, are perhaps derived from the more slender type, and possibly owe certain of their peculiarities to cross-breeding with the larger dogs, though this is at present wholly conjectural.

#### BREEDS OF AMERICAN ABORIGINAL DOGS.

While in a very general way it may be said, that excluding the Eskimo Dog, the American Indians had domestic dogs of two chief types, a larger and a smaller, there were apparently sundry local breeds of these, probably conforming in distribution with the general areas

occupied by the groups of tribes amongst which they were found. In the following pages an attempt is made to define such of these breeds as seem to be indicated by the fragmentary accounts of travellers as well as by the study of what skeletal remains have been available. No doubt the number of breeds recognized is subject to revision, for it has been found difficult to determine with any approach to certainty in some cases, what external and skeletal characters are to be associated, and in how far certain supposed breeds are mongrel or relatively pure. Again, the skeletal characters may frequently fail to give any clue to external traits that would be distinctive. Moreover, while the term "breed" is applied to these locally distinct forms of dogs, it is not assumed that the American natives made any conscious effort to change or keep constant the traits of their dogs; possibly some of the variations are merely the result of a certain mongrel mating, going on quite independent of human intent, so that, as in case of the Peruvian Pug-nosed Dog, the variation cropped out only occasionally and may or may not have been purposely preserved.

*Nomenclature.*—The bestowal of Latin names upon the different breeds of dogs recognized has here been purposely avoided, as it seems unwise to extend to such artificial variations the systematic recognition accorded natural species and subspecies. Nevertheless, Latin names or Greek letters have been used by other writers to indicate domestic breeds, and such names have been applied in many ways:—as trinomials, quadrimomials, or quinquenomials; sometimes separated from the binomial, *Canis familiaris*, by a comma or the abbreviation "var.," or otherwise used in such a way as to cause doubt as to their technical standing in systematic nomenclature. Some names of dogs have been erected in a strictly binomial fashion and if accorded standing, conflict with other names. Thus Rüttemeyer's *Canis palustris* (1863) of the Lake-dwellings is preoccupied by von Meyer's *Canis* (= *Galecynus*) *palustris* (1843). The name *Canis mexicanus* currently used for the Mexican Wolf proves to apply to the Mexican Hairless Dog only. Hodgson's *Canis laniger* (1845) for a Thibetan Wolf is preoccupied by Hamilton Smith's *Canis laniger* (1840) for the Nootka Sound Dog. Other cases might be added. The practice of using standard English (or vulgar) names for all artificial breeds is therefore to be recommended. With the descriptions following, a list of Latin names applied by previous writers is given under each breed.

## ESKIMO DOG.

## Plate 1, fig. 1.

1817. *Canis familiaris sibiricus groenlandicus* Walther, Hund, p. 27 (*vide* Fitzinger; not *Canis groenlandicus* Bechstein, 1799, q. c. *Alopex*).

1820. *C. f.* var. n. *borealis* Desmarest, Mamm., 1, p. 194.

1840. *Canis borealis* Hamilton Smith, Jardine's Nat. library. Mammalia, 10, p. 127, pl. 2.

*Characters*.—Size large, appearance wolf-like, but with less oblique eyes, less attenuated muzzle, and more elevated forehead; tall usually carried curled forward over the hip: teeth much smaller than those of the Wolf. Pelage thick, with a shorter under fur overlaid with longer hair which on the shoulders may be as much as eight inches long; tail bushy. Color whitish, more or less clouded on the back, with dusky, or varying to black, or black and white, or rarely tan and white.

*Distribution*.—The Eskimo Dog was originally found in Arctic America coextensively with the Eskimo tribes from the barrens of Alaska to Labrador, chiefly along the coast. In the east it was probably at its southern limit on the east coast of Newfoundland, and thence ranged northward, accompanying its Eskimo masters, to Smith Sound, Greenland. In Greenland it formerly was found along the west coast southward, with the natives, but the present-day sledgedogs of the Danish settlements are probably largely mongrel, through interbreeding with dogs introduced from Europe (Brown, 1875); and the same is true of those in Alaska and southern Labrador.

*External Measurements*.—An Eskimo Dog brought back by Parry, on his first voyage, is figured by Children (1827) who gives its dimensions as follows:—

Length, occiput to root of tail	28 inches	about 71	cm.
“ “ “ end of nose	11 “	“ 28	“
“ of tail (about)	18 “	“ 45.7	“
Total length (therefore about)	57 “	“ 145	“
Length of ear	3 “	“ 7.7	“
Eyes to point of nose	4 “	“ 10	“
Standing height at shoulder	24 “	“ 61	“

These figures do not indicate a very large animal. The very thick coat, especially on the shoulders, gives an increased appearance of size not well borne out by skeletal measurements. It should be kept in mind, that since the advent of Europeans, much attention has been

given to increasing the size and strength of these northern dogs for draught purposes. It is likely that the large wolf-like Eskimo Dogs now common in the North, are considerably different from the original stock found by the early Arctic explorers.

*Figures.* Children, J. G. Zool. journ., 1827, 3, pl. 1. From Parry's first voyage.

Audubon, J. J. and Bachman, J. Quadrupeds of North America, 1848, 3, pl. 113. Zoölogical Gardens, London.

Smith, C. Hamilton. Jardine's Nat. library. Mammalia, 1840, 10, pl. 2. Prince's Street Gardens, Edinburgh.

*Cranial Characters.*— Among the various skulls of so-called Eskimo Dogs examined, there is more or less disparity of size. This is no doubt an indication of the extensive crossing with European dogs that has been carried on for a long period with a view to improving the speed and strength for which this dog is useful. Skulls from eastern Kamtschatka are small, others from Alaska and Mackenzie are of superior size. It is therefore difficult at the outset to determine what the original Eskimo Dog of North America was really like. It is notable, however, that the teeth, even of the largest skulls are not much larger than those of medium-sized skulls, while in no case do they approach the magnitude of the Wolf's teeth. It would be of the utmost interest, in this connection, to compare the teeth of a known hybrid between the Eskimo Dog and a Wolf. Yet in spite of the frequency with which this cross is said to occur, there seem to be few skulls available. Windle and Humphreys (1890, p. 9) give the ratios of different parts of such a skull to the basicranial axis.

For lack of a more authentic standard, I have taken as typical of the Eskimo Dog, portions of a skull (M. C. Z. 10,537-10,539) exhumed by Dr. M. P. Porsild from an old village site at Sermermiut, west Greenland. While not of great size, this skull is notable for its broad palate, rather prominent trough-like depression between the frontals, and the high strong sagittal crest, yet is the surface of the brain-case comparatively smooth. Nearly similar is the skull of an Eskimo Dog from Hebron, Labrador, collected in 1897. Its wide palate and stout teeth are particularly noticeable as well as its strongly developed crests and broad forehead.

Measurements of the Skulls	M. C. Z. 10,538 Greenland	M. C. Z. 7,406 Labrador	U. S. N. M. 83,869 Baffin Land
Upper tooth-row, alveolus of $i^1$ to $m^2$	96	105	96
" " " " $c$ to $m^2$	81	87	79
" " " " $p^1$ to $m^2$	68	66	66
" " " " $p^2$ to $m^2$	62	59	58
" " " " $m^1$ to $m^2$	19	19.5	19
Length of carnassial, $p^4$	19.5	21	21
Width of palate outside $m^1$	75	75	69
Palatal length, alveolus of $i^1$ to median edge	98	?	94
Lower jaw, alveolus of $i_1$ to $m_3$	97	105	—
" " " " $c$ to $m_3$	89	99	—
" " " " $p_1$ to $m_3$	—	—	—
" " " " $p_2$ to $m_3$	72	74	—
" " " " $p_3$ to $m_3$	61	62	—
" " " " $p_4$ to $m_3$	50	49	—
" " " " $m_1$ to $m_3$	37	37	—
Length of carnassial, $m_1$	22	23.6	—
Width across postorbital processes	64—	52	52
" " zygomata	125	—	—
" " occipital condyles	45	49	43

Nathusius (1874) reports on ten skulls found near old Eskimo huts in Jackson and Sabine Islands, Greenland. The largest of these had a basal length of 189 mm., the smallest 175 mm. In skull U. S. N. M. 83,869 the basal length is 170 mm., the condylobasal length 180 mm., which may be the same dimension as the "basal length" of Nathusius.

In a series of nine skulls of Eskimo Dogs from Greenland, Baffin Land, Labrador, Mackenzie, Alaska, eastern Siberia and Kamtschatka, collected for the most part many years ago, it is notable that most are of about the same size as those of the Common Indian Dog. One or two from eastern Siberia are the smallest and most slender. All are heavy of bone, yet the sagittal crest does not show the strong backward overhang seen in the Wolf's skull. The muzzle in most is broad, yet this varies. The largest skull of all (U. S. N. M. 8,222) collected by Dr. W. H. Dall at Nulato, Alaska, is nearly as long as a small Wolf's, yet the teeth do not approach those of a Wolf in size. This and other large skulls of Eskimo Dogs, probably are the result of crossing with large dogs of European origin. Hearne (1796) speaks



of the large English dogs at the Fort on Hudson Bay; Ross (1861) notes the crossing of Eskimo Dogs with imported Pointers; and Harmon (1820) records that by the early part of the last century, large dogs imported from the English settlements of Newfoundland, had already been introduced in the fur countries as far west as the Rocky Mountains. It seems apparent that the large size of some present-day Eskimo Dogs is therefore due to the influence of imported stock, and that probably the aboriginal Eskimo Dog was not a much larger animal than the Common Indian Dog. The thick coat, however, often adds much to its apparent size.

It seems to be somewhat characteristic of the Eskimo Dog that the posterior narial opening (interpterygoid fossa) is broader and shallower, less contracted at its rearmost portion, than in dogs of other breeds, possibly correlated with their use in hauling and consequent need for deeper breathing. In this respect, however, there is some variation; yet in certain larger skulls which are presumably of mongrel dogs, the more narrowed and deepened fossa is obvious.

Thorndike (1911), in an interesting article on the Indian sled-dogs of North America, doubts if pure-blooded Eskimo or "Husky" Dogs are today found in North America except possibly about the Coppermine River, Banks Land and Wollaston Land. "In general, the Eskimo Dog differs from the Indian variety in being more wolfish and in having less European strain. His tail is more bushy and he is cleaner-legged. His ears are more erect and pointed, while his body is larger in size"—this in comparison with the mongrel dogs of the northern forest Indians of the present day.

*Origin.*—From its evident similarity of appearance to the Siberian Sledge-Dog, it is generally accepted that the two are of similar origin. The Siberian Dog seems indeed to differ in little except possibly its slightly smaller size. Dogs of the same type are found across northern Asia into Lapland, whence certain authors have concluded that the Eskimo Dog was undoubtedly brought from the Old World by the Eskimo themselves, who must already have known how to use them in harness. This view seems on the whole very probable. The ultimate derivation of the Eskimo Dog and the so-called Spitz Dogs in general, is however, still obscure. Some form of Wolf is commonly looked to as the remote ancestor of the breed though direct proof is not available. Holland (1908, p. 232) has even gone so far as to suggest that certain well-preserved jaws discovered in a Pleistocene cave-deposit at Frankstown, Pennsylvania, may from their resemblance to those of an Eskimo Dog, have come from a wolf-like ancestor

of this breed. The associated fauna, however, is of a more southern character than would be expected as companions of this Arctic dog.

Of the larger dogs of the New World, the Eskimo Dog is the only one that habitually carries its tail curled forward over the hip. This character, striking as it is, does not seem to have been particularly studied from the standpoint of heritability, to see if it behaves as a Mendelian character when contrasted with a drooping tail. Yet it is a highly important trait, and is found not only among the dogs of similar appearance in the north of Asia and Europe, but in other varieties, possibly related, and of more southern habitat in those continents. The so-called Chow Dog of China, a medium-sized red, or sometimes black (Kreyenberg, 1910) dog, with erect ears and powerful shoulders has the same sort of tail. A similar, though slightly smaller dog standing 50 cm. high at the shoulder is found among the Battaks of Sumatra (Studer, 1901, p. 31). The same curled tail is found in the Pomeranian Dogs, that appear in the decoration of Greek vases (Keller, 1909) or as figurines of Mycenaean times. The fact that the curled tail carried over the hip is so widely characteristic of certain breeds of Old World dogs, where it seems to have been known from ancient times, implies that it originated there and strengthens the view that the Eskimo Dog came from Asia with the Eskimo. The contention that "the canine of the American aborigine, or Amerind, was simply a tame wolf, differing from its wild brother in the qualities that would naturally follow breeding in the semi-domestication of the savage" and that the dog "bred by the Indians in the forest regions, and the Eskimos, was always derived from the Gray wolf" (Thorndike, 1911), seems only remotely true. There is much evidence, though of a somewhat uncertain character, that wild male Wolves will breed with female Eskimo Dogs at proper seasons, and the northern Indians are said to encourage such occasional crosses. Thorndike states that tame wolves are sometimes seen in harness with the dogs in the North. Nevertheless, under usual circumstances, those who have lived in Arctic countries agree that wolves are highly unfriendly with the dogs, and a single wolf is more than a match for several dogs. There seems to be no evidence that Wolf cubs were habitually reared by either Eskimo or Indian, which one would expect to be the custom if the Eskimo Dog is merely a Wolf, tamed. Hearne (1796) mentions that some Indians, on finding a Wolf's den, fondled the little cubs, and painted their faces with vermilion, but returned them to the den and made no attempt to rear them. He adds (p. 362) that "all the wolves in Hudson's Bay are very shy of the human race, yet when sharp set,

they frequently follow the Indians for several days, but always keep at a distance. They are great enemies to the Indian dogs, and frequently kill and eat those that are heavily loaded, and cannot keep up with the main body."

A comparison of available skulls indicates that those of Eskimo Dogs from eastern Labrador and western Greenland are constantly smaller than those of eastern wolves, the teeth markedly smaller. European investigators (Studer, 1901; Anutschin, 1881; Woldrich, 1882) have described skulls and other bones of large dogs from deposits of the later Stone Age — Neolithic — one or two of which, the so-called *C. f. inostranzewi*, *C. f. ladogensis*, seem to be large animals much like Eskimo Dogs, and are considered as belonging to the same group.

Eiffe (1909) records a crossing of the Australian Dingo with an Eskimo Dog, in the Hamburg Zoölogical Gardens. The Dingo, a female, was an unusually pale reddish brown animal; the dog, a black East Siberian Sledge-Dog. The eight pups of this litter were more reddish in color than their mother, with slightly bushy tails, somewhat bowed upward. The old Dingo then paired with one of these reddish dogs, and produced eight young, five very pale like herself, three darker red. The ears of all the young were not at first erect, but became so in the course of five months.

*Notes.*—The accounts of the early voyagers leave no doubt that these large dogs were companions of the Greenlanders and American Eskimo before the coming of Europeans. Their use by the natives as sledge-animals makes them of prime importance in the Arctic conditions under which they live. Cranz and Egede, early Danish missionaries to Greenland, mention the dog-teams, and the latter author gives a crude figure. Scoresby in his *Greenland Journal*, (1823, p. 203) relates finding at Jameson's Land in eastern Greenland, the skull of a dog in a small grave, probably that of a child. The Eskimo of this part of Greenland must have had very little contact with Europeans up to that time. Cranz, in his *History of Greenland*, alludes to this custom of the natives, who believe that by laying the head of a dog beside the child's grave, the animal will show the ignorant babe the way to the Land of Souls, for a dog can find its way everywhere.

Among early accounts of the Eskimo Dogs, several of special interest are given in Hakluyt's *Voyages*. In The second voyage of Master Martin Frobisher, made to the West and Northwest regions, in the yeere 1577 (Hakluyt's' *Voyages*. Everyman's Library ed., 5, p. 137), it is related that a landing party at York Sound examined

the deserted tents of the Eskimos, "not taking any thing of theirs except one dogge." The possessions of these people are described, including "also dogges like unto woolves, but for the most part black, with other trifles, more to be wondred at for their strangenesse, then for any other commoditie needefull for our use." Again, "they frank or keepe certaine dogs not much unlike Wolves, which they yoke together, as we do oxen & horses, to a sled or traile: and so carry their necessities over the yce and snow from place to place: as the captive, whom we have, made perfect signes. And when those dogs are not apt for the same use: or when with hunger they are constrained for lacke of other victuals, they eate them: so that they are as needfull for them in respect of their bignesse, as our oxen are for us." At Leicester's Island, in the present Frobisher Bay, a captive Eskimo caught one of the Englishmen's dogs and showed how the natives trained their animals. In the narrator's words, "Taking in his hand one of those countrey bridles, he caught one of our dogges and hampred him handsomely therein, as we doe our horses, and with a whip in his hand, he taught the dogge to drawe in a sled as we doe horses in a coach, setting himselfe thereupon like a guide: so that we might see they use dogges for that purpose that we do our horses. . . . They drawe with dogges in sleads upon the yce, and remoove their tents therewithall wherein they dwell in Sommer." This seems to be the earliest account of Eskimo Dogs in Arctic America by Englishmen. It is interesting to find that the explorers carried a dog with them from Europe, showing the possibility at an early date, of contamination of the breed with European dogs. John Davis, who sailed from England in June, 1585, "for the discoverie of the Northwest passage," met with Eskimo Dogs in August, in Cumberland Sound. His chronicler relates that here "we heard dogs houle on the shoare, which we thought had bene volves, and therefore went on shoare to kill them. When we came on land the dogges came presently to our boat very gently, yet we thought they came to pray upon us, and therefore we shot at them, and killed two: and about the necke of one of them we found a leatherne collar, whereupon we thought them to be tame dogs. There were twenty dogs like mastives with prickt eares and long bush tailes" (Hakluyt's *Voyages*, Everyman's Library ed., 5, p. 289).

At the present day, it is unusual to see typical Eskimo Dogs south of Hamilton Inlet on the Labrador east coast, though many mongrel individuals are found about the settlements between there and Newfoundland. Three centuries ago, however, the natives of the latter

island had dogs which from their apparent resemblance to wolves, may have been of the Eskimo breed. For Whitbourne, in his "Discourse and Discovery of Newfoundland" (London, 1622) writes that the natives of Newfoundland "are a people that will seeke to revenge any wrongs done unto them or their Woolves, as hath often appeared. For they mark their Woolves in the eares with several markes, as is used here in England on Sheepe and other beasts, which hath been likewise well approved. For the Woolves in these parts are not so violent and devouring as Woolves are in other Countries." The same writer speaks with astonishment of his own mastiff's familiarity with these tamed "Woolves" (Mercer, 1897), which it seems reasonable to conclude were really Eskimo Dogs.

Of the Eskimo Dog in Greenland, Brown (1868, 1875) considers the breed to be practically the same as that of Davis Straits and Kamtschatka. In western or Danish Greenland he found it more or less mixed with dogs of European descent and south of Holsteensborg not used by the Eskimo, as the sea is not sufficiently frozen over in winter for sledging. The same author adds that in 1861, Prof. Otto Torell brought several dogs from Greenland for the use of his expedition in Spitzbergen, where on account of the open water they were found useless and set free. Within a few years they were said to have increased in numbers.

#### PLAINS-INDIAN DOG.

*Characters.*—Size medium, slightly smaller than the Eskimo Dog; ears large, erect; tail drooping or slightly upcurved; coat rather rough, usually "ochreous tawny" or "whitish tawny," or sometimes black and gray, mixed with white.

*Distribution.*—Western North America from British Columbia south perhaps to the Mexican Boundary and eastward through the Great Plains Region.

*Notes and Descriptions.*—It is apparently to this dog that most of Lord's description (1866, 2, p. 222) applies in his Naturalist in Vancouver Island and British Columbia. So impressed was he by the general similarity of these dogs to coyotes, that he believed the one derived from the other, and makes one general description do for both, with the addition that in the dog the hair "becomes shorter, softer, and more uniform in coloration, although the tail retains its bushy appearance." The general color is an "ochreous grey," the hairs tipped with black, those of the neck tricolored, having their

"lower two-thirds reddish brown; then a ring of white, and a black tip." This pattern gives "a most curious speckled look" to the bristling neck of an enraged dog. Coues (1873) was equally impressed by the general resemblance of these dogs of the Plains Indians to coyotes and considered the two animals essentially the same in structural points, though he thought it "unnecessary to compare the skulls." Indeed, he accepted it as unquestionable that in every Indian community mongrel dogs are found, shading into coyotes in every degree. Such crosses he says, are obtained by picketing female dogs over night at proper times, thus allowing them to cross with coyotes. Morton (1851) quoting a letter from Dr. Cooper, Fort Duncan, Texas, speaks of every ranch having a dog resembling a coyote, "and a bitch to which no dog had had access, produced whelps, evidently a cross with the *Coyote*." Wortman, also (in Cope and Wortman, 1884, p. 8, footnote) after extended travel in the western United States corroborates Coues — but from hearsay evidence, however. He found among the Umatillas, Bannocks, Shoshones, Crows, Arrapahoes, and Sioux, mongrel dogs, "which to one familiar with the color, physiognomy and habits of the coyote, have every appearance of blood relationship," if they are not "in many cases, this animal itself in a state of semi-domestication." All such evidence, however, is unsatisfactory, and rests on general resemblances in form, color, and characteristics that may be common to both animals. A comparison of skulls and teeth would perhaps reveal more significant tokens of the true relationship, but hitherto nothing has been published as to the cranial characters of such animals. Yet, in his much-quoted paper on the origin of the American varieties of the dog, Packard (1885) appears to have been influenced by Coues's belief, and agrees with him in considering these dogs as merely tamed coyotes. In a journey through provincial Mexico he was struck by the general resemblance of the native dogs to these animals, and again, in 1877, on the upper Missouri took special note of the dogs of the Crow Indians, describing them as of wolf-like appearance, of the size and color of a coyote — a whitish tawny — but less hairy and with less bushy tails. Lord (1866, 2, p. 221) found a number of dogs with a little tribe of Indians at Sweltza, a small lake west of the Cascades, near which the boundary of British Columbia passes, "that were hardly in any degree altered from the coyote" in exterior appearance. He speaks of their burrowing deeply into the ground to bring forth their young, but this trait is found in dogs as well as in coyotes. From these accounts it is clear that the general appearance and coloration of this dog are strikingly

like those of one of the coyotes. Hamilton Smith (1840, p. 156) refers to the same dog as the "*Techichi* of Mexico, or the Carrier-dog of the Indians," and gives a figure (Pl. 4) of the only example he had seen, a tawny dog of normal proportions and with cropped ears. He confuses it however, with Richardson's "Carrier-Indian" or Short-legged Dog and further complicates his account by supposing it the same as the Mexican *Techichi*.

James Teit (1909) writing of the Thompson Indians of the upper Fraser River, British Columbia, also remarks on the general resemblance of their dogs to coyotes, but adds that through intercrossing with dogs imported by the whites, the breed has become totally extinct. They were good hunters, though poor watch-dogs, and the best ones for deer hunting were highly prized. Such dogs generally ran the deer to water, often bringing it to bay in some creek, and keeping it there till the Indian came up and dispatched it.

It is regrettable that more thorough comparison of the teeth of these dogs could not be made to test any supposed resemblance or relationship to coyotes. As Gidley (1913) has pointed out, the fourth lower premolar of the latter has normally *two* secondary cusps and a cingulum, that of the dog normally but *one* secondary cusp, a ready means of distinction in addition to other relative characters. It should be added that in numerous fragments I have examined from the southwest, there is no evidence of coyote influence.

Referable to this same breed are perhaps the *larger* dogs mentioned by Suckley (Suckley and Gibbs, 1860, p. 112) as kept by the Indians "about the Dalles of the Columbia," Oregon. These he describes as about the size of a foxhound, but much more slender, in color yellow or brindled.

A similar type of dog seems to have been kept by the Indians of California. At all events, a series of skulls from mounds on the southern coastal islands are hardly to be distinguished from New Mexican skulls. A skull found in association with that of an Indian, washed out after a freshet, from a bank at the junction of the Tuolumne and San Joaquin Rivers, California, is of the same medium-sized type, rather heavy of bone, slender of muzzle, and with feeble sagittal crest, mainly on the occiput.

*Skeletal Measurements.*—A cranium discovered in the course of excavations by Dr. A. V. Kidder at Pecos, New Mexico, may be attributed to this dog. It is nearly identical in size and proportions with several of the skulls from southern California from mounds on the island of San Nicolas, kindly loaned me by the Archaeological

Department of the University of California. These last are in an excellent state of preservation, of medium size, yet of massive bone, with roughened brain-case, and sagittal crest developed mainly on the interparietal region. The teeth are rather small, the first upper premolar lacking in some cases.

The following table gives the cranial measurements of several of these skulls. The first two, from Pecos, N. Mex., differ in that the one, a rostrum only, is considerably larger than the other, or any of the Californian skulls. Of the latter, there are several from mounds on San Nicolas Island, which represent a dog apparently identical with that of New Mexico. The last two columns give dimensions of two old dogs with much worn teeth; in the larger, indeed, the upper molars have been lost and their alveoli partially filled, while the remaining teeth are mere stumps. The smaller of these two skulls, while not very different in the measurements of the tooth-row, has a shorter, smaller cranium. It is very likely a mongrel between this larger dog and one of the short-nosed dogs ('Pachycyon'), a relationship further indicated by its slightly more upturned snout. It is further peculiar in lacking the first upper premolars on both sides, while in the lower jaw there are on both sides *four* molars, the second and third each with two roots and the fourth single-rooted like the usual third molar. Four molars in the lower jaw is not an unknown feature in the dog. Nehring (1882) found twenty dog skulls out of 650 in which there was an extra molar either in both upper or both lower tooth-rows, or in only one tooth-row.

Lucas (1897) has given a brief account of the cranium of a large dog, evidently domesticated, found in an ancient Pueblo Indian grave at Chaves Pass, Arizona, in 1896. Another of similar proportions was discovered at San Marcos, Texas, associated with flints, a human skeleton, and other bones. The former skull he regards as of a "broad-faced type," and describes it as "precisely similar in size and proportions to the cranium of an Eskimo dog from Cumberland Sound." He supposes these to be carrier-dogs, and recalls Clavigero's mention of them as "a quadruped of the country of Cibola [New Mexico], similar in form to a mastiff, which the Indians employ to carry burdens." I have not been able to examine these skulls, but they may be the same as the larger of the two New Mexico skulls here listed.



Measurements of the Skulls	N. Mex.: Pecos M. C. Z. 9,323	N. Mex.: Pecos M. C. Z. 9,322	Cal.: Stani laus Co. U. C. 2,430	Cal.: S. Nicolas Id. U. C. 16,349	Cal.: S. Nicolas Id. U. C. 16,351	Cal.: S. Nicolas Id. U. C. 16,348	Cal.: S. Nicolas Id. U. C. 16,350
Occipitonasal length (excluding incisors)	—	173	170	164	172	178	159
Basal length	—	153	151	146	153	156	143
Palatal length	91	82	85	81	81	88	81
Median length of nasals	—	49	54	—	49	54	50
Alveolus of $i^1$ to anterior edge of orbit	82	74	73	67	72	72	68
Alveolus of $i^1$ to $m^2$	95	86.5	89	86	88	91.5	85
“ “ canine to $m^2$	77	71	74	69	72	75	70
“ “ $p^1$ to $m^2$	65	59.5	60	57	58	59	—
“ “ $p^2$ to $m^2$	57	53	56	50	52	55	51
“ “ $p^3$ to $m^2$	46	42	45	40	42	—	41
“ “ $p^4$ to $m^2$	34	33	34	30	32	32	31
Alveoli of $m^1$ and $m^2$	18	17	18	16.5	19	17	16.5
Length of carnassial ( $p^4$ )	19	18	20	19	17.5	—	17
Width of occipital condyles	—	33	34	31	33	36	33
“ “ palate at $m^1$	64	60	59	61	66	67	57
“ across supraorbital processes	—	47	43	55	53	54	46
Zygomatic width	—	—	97	106	112	111	97
Lower jaw, alveolus of $i_1$ to $m_3$	—	—	—	—	89	92	87
“ “ “ “ canine to $m_3$	—	—	—	—	80	85	79
Lower jaw, alveolus of $p^1$ to $m_3$	—	—	—	—	65	67	64
“ “ “ “ $p_2$ to $m_3$	—	—	—	—	62	63	61
“ “ “ “ $p_3$ to $m_3$	—	—	—	—	53	55	52
“ “ “ “ $m_1$ to $m_3$	—	—	—	—	34	34	33
Length of $m_1$ (carnassial)	—	—	—	—	21	20	21

*Uses.*— These dogs of medium size, were chiefly used by the Indians in transportation, secondarily in hunting. In the plains country from Saskatchewan to the Mexican Boundary, the *travois* was in general use. This consisted of two light poles, the smaller ends fastened together and resting on the dog's shoulders, the heavier ends

kept apart by a crosspiece and trailing behind. A leather collar served to keep this frame in place for dragging the goods piled upon it. In this way entire villages moved, the dogs dragging the household effects. The contrivance seems not to have been used west of the Rocky Mountains. Perhaps the earliest mention of the use of these dogs as pack-animals is found in Coronado's account of his journey in 1540 to 1542, from the City of Mexico to the Texas plains (see translation by Winship, G. P., 1904). When some ten days' march from the present Rio Pecos, Texas, Coronado and his followers came to Haxa, where the natives were found to have "packs of dogs." In moving camp, these Indians started off "with a lot of dogs which dragged their possessions." "They travel like the Arabs, with their tents and troops of dogs loaded with poles and having Moorish pack saddles with girths. When the load gets disarranged, the dogs howl, calling some one to fix them right." A letter from one of Coronado's men further describes the dogs. "These people," he writes, "have dogs like those in this country [Spain], except that they are somewhat larger, and they load these dogs like beasts of burden, and make saddles for them like our pack saddles, and they fasten them with their leather thongs, and these make their backs sore on the withers like pack animals. . . . When they move — for these Indians are not settled in one place, since they travel wherever the cows [*i. e.*, Bison] move, to support themselves, these dogs carry their houses, and they have the sticks of their houses dragging along tied on to the pack saddles, besides the load which they carry on top, and the load may be, according to the dog, from 35 to 50 pounds." Evidently these were the carrier-dogs of the Plains Indians, and the method of packing with the tent poles used as *travois* seems to be here first described.

As pack-animals, for moving camp in their pursuit of the Bison, these dogs were of great service to the Indians of the plains country, and every village was provided with troops of them.

As an article of food, the dog seems to have been somewhat analogous to the fatted calf. George Catlin (1841, 1, p. 14) writing of the Upper Missouri Indians, says: "We are invited by the savages to feasts of *dog's meat*, as the most honourable food that can be presented to a stranger."

## SIOUX DOG.

*Characters.*—A large wolf-like dog, probably closely related to the Plains-Indian Dog but larger and gray rather than tawny in color.

*Distribution.*—Probably the north-central plains area, from the Missouri north perhaps to Saskatchewan.

*Notes.*—No doubt the carrier-dogs differed slightly among the various tribes of Plains Indians covering the wide stretch of country from Northern Mexico to Saskatchewan, so that local breeds of the general type could be distinguished did we have opportunity to compare them. Morton (1851), who tried to obtain information from frontier officers in the earlier half of the last century, quotes a letter from H. H. Sibley, a correspondent in Minnesota, who avers that "the Indian Dog differs much in size and appearance among different tribes" but that they all have small, sharp, erect ears. He particularly recalls that "among the Sioux, it is large and gray, resembling the Buffalo Wolf." Packard (1885) has mentioned "whitish tawny" Indian dogs seen in 1877, among the Crows of the upper Missouri. Lewis and Clark, on their famous journey, came upon a scaffold burial of an Indian squaw, near which lay two dog-sleds and the carcass of a large dead dog, between Mandan and the Yellowstone. These large gray dogs of the Sioux may have been a distinct breed from the tawny dog, of the size of a Coyote, and possibly the same as certain large dogs seen by Hind (1859) among the Crees of the Sand Hills. Sir John Franklin (in his *Journey to the shores of the Polar Sea*, 1829, 1, p. 176) briefly mentions the large dogs of the Crees in the Saskatchewan country. He adds that in the month of March, the female wolves "frequently entice the domestic dog from the forts, although at other seasons a strong antipathy seemed to subsist between them."

Hamilton Smith (1840) quotes an interesting letter from Prince Maximilian of Wied, likening the North American plains dog to a wolf, "excepting that the tail is more curved, and the color either "absolutely grey like wolves" or white, black, and black and white spotted. The latter coloring, however, may apply to some other breeds than that under consideration.

Figures probably representing this dog, are shown in some of the plates of Catlin's *Indians* (1841, colored edition, 2) small to be sure, but showing the gray coloring, large erect ears, and scimitar-shaped tail carried out behind. His Plate 103 in 2 is a spirited drawing illustrating a dog-fight in which all the dogs of the party, though burdened with their loads "*en travail*," are rushing to participate.

## LONG-HAIRED PUEBLO DOG.

*Characters.*— A medium-sized dog of slender muzzle, erect ears, and normal bushy tail. Hair long and dense, pale yellowish, clouded with dark brown on ears and crown, whitish beneath on throat, belly, and feet. Feet well-haired. Probably this is to be looked upon as a local breed of the Plains-Indian Dog, from which it apparently differs only in its longer coat.

*Distribution.*— Known only from the Marsh Pass region of Arizona, but in former times probably common to the Pueblo tribes of Arizona and New Mexico.

*General Account.*— One of the remarkable discoveries of Messrs. Guernsey and Kidder, while exploring for the Peabody Museum, was an excellently preserved specimen of a medium-sized dog associated with a human burial. In the arid climate of Arizona, the dog had merely dried, so that the entire animal even to the thick hair was nearly intact. It is covered with a dense coat of long woolly hair, of a pale yellowish color, clouded on the back and head with brownish. On the sides of the body, the length of the hair is about 100 mm.; on the toes 30 mm. The culture period to which this specimen belongs, is believed by Mr. Guernsey to antedate that of the Cliff Dwellers, and hence must be at least several centuries old.

It seems probable that it was to this long-haired dog that Mendoza, a companion of Coronado, refers in a letter of 17 April, 1540, to the King of Spain, describing the pueblo of Cibola, then a famous Indian site, near the present town of Zuñi, New Mexico. This letter is translated by Winship (1904, p. 153) from the Spanish of Pacheco y Cardenas, (*Documentos de Indias*, 2, p. 356), and contains the following passage:— "In their houses they keep some hairy animals, like the large Spanish hounds, which they shear, and they make long colored wigs from the hair, like this one which I send to Your Lordship, which they wear, and they also put this same stuff into the cloth which they make." These "hairy animals, like the large Spanish hounds," seem probably, in the light of Mr. Guernsey's discovery, to have been the same as the dog found at Marsh Pass. It is recalled here that breeds of long-haired dogs were kept for shearing not only by the Indians of Puget Sound, but by the Chonos of the Taitao Archipelago, Chile, and their hair woven into blankets (see p. 475). There was formerly a breed of long-haired white or brown dogs among the aboriginal inhabitants of New Zealand, the product of which was similarly used (Colenso, 1878).

*External Measurements.*— It is not possible to remove the skull and limb-bones without injuring the mummy for exhibition purposes. A few dimensions, however, follow:—

Length from nose to root of tail, following backbone — about	700 mm.
Length of tail, (broken at tip) slightly over	200
Hind foot	141
Femur (approximately)	145
Tibia (approximately)	143
Upper jaw, front of canine to back of $pm^4$	55.5
Upper carnassial ( $pm^4$ )	18
Length of skull from occiput to tip of nose (approximately)	195
Width outside upper canines	31
“ “ carnassials	54
Zygomatic width — about	95
Lower jaw, front of canine to back of $m_1$	68.5
“ “ “ “ “ “ “ “ $pa$	49
“ “ $pm_1$ to $pm_4$	35
Length of lower carnassial	21

#### LARGER OR COMMON INDIAN DOG.

##### Plates 7, 8.

1817. *Canis familiaris americanus canadensis* Walther, Hund, p. 43.  
 1829. *Canis familiaris* var. *c. canadensis* Richardson, Fauna Boreali-Amer., 1, p. 80 (not *Canis lupus canadensis* Blainville 1841, which is *Canis lycaon* Schreber).  
 1834-6. *Canis canadensis* Reichenbach, Regn. anim., pt. 1, p. 46, fig. 564.  
 — *Canis familiaris orthotus canadensis* Reichenbach, Naturg. raubth., p. 146, fig. 564.  
 1867. *Canis domesticus borealis luparius* Fitzinger, Sitzb. K. akad. wiss. Wien, 56, pt. 1, p. 409 (not *C. f. orthotus luparius* Reichenbach, Regne anim., pt. 1, p. 13, fig. 131; not *Canis domesticus luparius* Fitzinger, Sitzb. K. akad. wiss. Wien, 1866, 54, pt. 1, p. 406; 1867, 56, pt. 1, p. 396).  
 1881. *Canis latrans domesticus* Langdon, Journ. Cinc. soc. nat. hist., 3, p. 299 (not *Canis familiaris domesticus* Linné, 1766).

*Characters.*— This was probably closely related to the Plains-Indian Dog, but seems to have been usually solid black or black and white in patches instead of resembling the Coyote in color. The skull has, when adult, a knife-like sagittal crest, a high forehead, and is rather slender. Limbs much longer than in the Short-legged Indian Dog

yet slightly inferior to those of a Greyhound. The first lower premolar was frequently wanting.

*Distribution.*— Dogs of this general type, agreeing fairly well in size and proportions were found among the forest Indians from Alaska southward to Florida and the Greater Antilles, and westward to the edge of the plains in the east central States. The more northern dogs seem to average a little larger than those from the south, but in the absence of more exact knowledge seem best referred to this type. No doubt in the far Northwest there was more or less mixture with the Eskimo Dog. Probably too, local strains of this general type of dog could be distinguished, did we know their external characteristics, but the skulls and teeth seem remarkably similar over a wide area.

*Skeletal remains.*— Cope (1893) was the first to describe the jaw of this dog from a specimen collected by Moore from a shell-mound on St. John's River, Florida. He was struck by the fact that the first lower premolar was missing and appeared not to have developed. The strong development of the entoconid of the carnassial, he also noticed. Moore, in the course of various explorations in Florida and Georgia discovered many remains of dogs, apparently of this type. In a large mound on Ossabaw Island, Georgia, he (1897) found several interments of human and dog-skeletons, the latter always buried separately and entire, showing that the dogs had not been used as food. Other dog-skeletons of a similar sort were found by Moore (1899) in aboriginal mounds on the South Carolina coast. Several of the skulls collected by him are in the Peabody Museum, where I have had the privilege of studying them. Putnam (1896) considered them the same as those of the larger Madisonville dogs. More recently the M. C. Z. has received from Prof. Carlos de la Torre, two fragmentary skulls of dogs associated with pre-Columbian burials in Cuba. These skulls seem to be essentially similar as far as can be judged. Miller (1916) has reported a lower jaw of a dog from an Indian site in Cuba.

Three crania in excellent condition, from the Madisonville, Ohio, site agree in their somewhat slender proportions, with narrow palate and rostrum. A strong but thin bony crest is developed along the midline of the brain-case, and there is a noticeable inflation of the region just back of the supraorbital processes. The first premolar is absent in both cranium and jaw of one specimen. Two crania from a shell-heap at La Moine, Maine, similarly lack the first premolar. One of these latter is a much larger skull than any of those from Madisonville, which may indicate some variation in the local breeds,

yet the general type seems to be the same. Hardly distinguishable from the Maine specimens in any way is a skull from Peel River, Yukon, (U. S. N. M. 6,219) collected about 1860 by Kennicott and representing probably the common Indian Dog of that region.

Cranial Measurements	Ohio: Madisonville P. M. 58,528	Ohio: Madisonville P. M. 71,801	Ohio: Madisonville P. M.	Yukon: Peel R. U. S. N. M. 6,219	Ala.: Montgomery P. M. 68,808	Ga.: Osceola Id. P. M. 52,362	Cuba M. C. Z. 10,004	Maine A. C. 53,902	Maine A. C.
Alveolus of $i^1$ to occipital condyle..	170	172	163	177	163	169	—	192±	168
Median length of nasals.....	56	62	57	—	57	57	—	—	—
Alveolus of $i^1$ to median edge of palate.....	85	90	87	88	86	90	—	93	—
Alveolus of $i^1$ to anterior edge of orbit.....	74	77.5	74	81	74	77	—	—	70±
Alveolus of $i^1$ to $m^2$ .....	86	90	87	96	86	90	—	—	83
“ “ canine to $m^2$ .....	72.5	75	72	79	71	74	74	86	70
“ “ $p^1$ to $m^2$ .....	60	62.5	—	—	59	60	64	—	—
“ “ $p^2$ to $m^2$ .....	52	56	55	62.5	52	52	55	—	56
Alveoli $m^1$ and $m^2$ .....	18.2	—	20.8	19	17	17	16.3	—	19.8
Length of $p^4$ .....	19	18	18.6	20.5	17.5	18.5	—	20.8	19.7
Width of occipital condyles.....	31	37.5	34	40	36	34	38	40	37
“ “ palate at $m^1$ .....	59	57	61	66.5	54	60	62	68	55
“ “ across supraorbital processes.....	50	51	47	49	46	57	—	60	—
Zygomatic width.....	102	98	104	101	92	104	—	—	—

Of seven lower jaws from Maine shell-heaps, all but one lack the first premolar, and the same tooth is lacking in a ramus from Madisonville. It seems to be missing in the greater portion of lower jaws of this dog. The following measurements show the lengths of different parts of the tooth-row taken at the alveolar borders, because the teeth themselves are frequently lost.

Tooth-row Measurements	Maine: Sawyer's Id.	Maine: Sawyer's Id.	Maine: Sawyer's Id.	Maine: Calf Id.	Maine: Calf Id.	Yukon: Peel River	Ohio: Madisonville
Alveoli, $i_1$ to $m_3$	99	—	100	—	97	105	87
" $c$ to $m_3$	94	—	94	—	92	99	—
" $p_2$ to $m_3$	72.5	74	74	75	71.5	77	65
" $p_3$ to $m_3$	61	63	62	64	62	65	—
" $p_4$ to $m_3$	49	49	50	49	50	50	—
" $m_1$ to $m_3$	37	36	38	37	39	38	33.5
Length of tooth, $m_1$	22.5	22.3	23	21.5	24	23	21

*Skeletal Measurements.*—The first of the Calf Island jaws above, is accompanied by parts of the skeleton of the same animal. The limb-bones of this skeleton and those of several dogs from Madisonville, Ohio, measure:

	Maine: Calf Id.	Ohio: Madisonville	Ohio: Madisonville	Ohio	Ohio	Ohio	Ohio	Ohio	Ohio
Humerus	168	163	162	—	—	—	—	—	—
Radius	164	—	—	164	163	—	—	—	—
Femur	170±	—	—	—	—	173	—	—	—
Tibia	172	—	—	—	—	—	177	160	156

*Notes and Descriptions.*—On account of the finding of cranial fragments that appear to represent this animal, in aboriginal burials in Cuba, it is assumed that this is the dog mentioned by the first discoverers under Columbus. Oviedo (1535) writing of the aboriginal dogs in Haiti shortly after the discovery, declared that they were no longer to be found there in 1535, as all had been killed for food during a time of famine. These dogs he described as of all the colors found among the dogs of Spain, some uniformly colored, others marked with blackish and white, or reddish brown. The coat of some was woolly, of others silky or satiny, but most of those in Haiti were between silky and satiny, yet rougher than the Spanish dogs; with ears pointed and



erect like those of wolves. None of these dogs barked. Oviedo adds that similar dogs were plentiful in many parts of the continent, as in Mexico, Santa Marta, and Nicaragua. He had eaten their flesh and considered it excellent, resembling lamb. In Nicaragua and Mexico the Indians bred numbers of them and at their great festivals dog-meat was considered the best dish of all. The natives of Haiti hunted some species of *Hutia* with these dogs.

Very little seems to have been written descriptive of this breed. In his essay on the origin of dogs, Hunter (1787) mentions that a Mr. Cameron, who had lived among the Cherokee Indians, informed him that the dog found in their country was "very similar to the wolf." Cameron thought it remarkable there were not sundry breeds of dogs among these Indians, as in Europe. William Bartram (1792, p. 220), during his travels in Florida, made special note of a "single black dog, which seemed to differ in no respect from the wolf of Florida, except his being able to bark as the common dog." It belonged to an Indian, who had trained it to tend a troop of semiwild horses, "keeping them in a separate company where they range; and when he is hungry or wants to see his master, in the evening he returns to town, but never stays at home at night." Barton (1805) appears to have made more particular inquiry of Bartram concerning these Indian Dogs of Florida, and describes them as "very similar to the *Canis Lycaon*, or black wolf," yet they are not always black "but of different colours, commonly of a bay colour, and about one third less than the wild black wolf. It carries its ears almost erect, and has the same wild and sly look that the wolf has." Barton adds that the dogs of the Cherokees were already (1805) much intermixed with the European dogs.

Peter Kalm informed John Bartram that the dogs of the Canadian Indians (?Montreal) were like those in Sweden with erect ears, and Bartram himself (in a letter to George Edwards, 1757) recalled as a boy seeing the Indian Dogs, with erect ears, accompanying their masters on occasional visits to his father's house in Pennsylvania. Barton (1805), who seems to have made diligent inquiry about these dogs, further describes their aspect as "much more that of the wolf than of the common domesticated dogs. His body, in general, is more slender than that of our dogs. He is remarkably small behind. His ears do not hang like those of our dogs, but stand erect, and are large and sharp-pointed. He has a long, small snout, and very sharp nose." This breed, he says, was still preserved in the greatest purity among the Six Nations, from whom the Delawares acknowledge that they received it.

Judging from the numerous shell-heap remains of what seems to be this same dog, it was formerly common among the New England Indians. In Hakluyt's Voyages (Everyman's Library ed., 6, p. 95) is an account of The voyage of the ship called the Marigold of Mr. Hill of Redriffe unto Cape Briton and beyond to the latitude of 44 degrees and an half, 1593. The narrator tells of meeting with a party of "Savages" at Cape Breton in July, who upon the accidental discharge of a musket, came "running right up over the bushes with great agilitie and swiftnesse... with white staves in their handes like halfe pikes, and their dogges of colour blacke not so bigge as a greyhounde followed them at their heeles; but wee retired unto our boate."

It is probably to this breed of dog that Charlevoix refers in his Journal of a voyage to North America (London, 2 vols, 1761, transl.). "The Indians," he writes, "always carry a great number of dogs with them in their huntings; these are the only domestick animals they breed, and that too only for hunting; they appear to be all of one species, with upright ears, and a long snout like that of a wolf" (1, p. 187).

This is the "major" type of Indian dog reported by Loomis and Young (1912) from Maine shell-heaps, where rather large-sized specimens have been discovered. Dog-remains have been found also in Connecticut (MacCurdy, 1914) and Block Island, R. I. (Eaton, 1898).

An Indian Dog-skull (Plate 7) collected by Kennicott on the Peel River, about 1860 (U. S. N. M. 6,219) is hardly different, except for its very slightly greater size, and seems best referred to the same sort of dog, though possibly a distinguishable breed. Richardson (1829) named this dog *Canis familiaris* var. *canadensis*, and says it is the kind "most generally cultivated by the native tribes of Canada and the Fur countries." He describes it as intermediate in size and form between the Eskimo and the Hare-Indian Dog. Its fur is black and gray, mixed with white; some are all black. Apparently identical with the skull from Peel River is another collected by Dr. W. H. Dall, from a prehistoric Aleut village site in Unalaska. Dr. Dall notes that this is the only dog-skull which had been found in the undeniably prehistoric kitchen-middens of the Aleutian Islands. It still retains the upper carnassial, which measures 20.5 mm. in length. The occipital condyles are 38 mm. across. The first upper premolar was apparently lacking.

Probably it was a dog of this breed that Audubon figured as the Hare-Indian Dog, from a living one in the gardens of the Zoölogical

Society of London. Bernard R. Ross (1861) seems to have confused the two as well; for a skull collected by him at Fort Simpson and sent to the U. S. N. M. as "*Canis lagopus*" is even larger than the one from Peel River and almost undoubtedly a cross with an Eskimo Dog. Both skulls lack the first lower premolar.

In the North the Common Indian Dog is largely used among the forest Indians as a beast of burden.

Samuel Hearne, on his famous journey to Peel River, 1769-72, observed that the Indians' "kettles, and some other lumber, are always carried by dogs, which are trained to that service, and are very docile and tractable. \* \* \* These dogs are equally willing to haul in a sledge, but as few of the men will be at the trouble of making sledges for them, the poor women are obliged to content themselves with lessening the bulk of their load, more than the weight, by making the dogs carry these articles only, which are always lashed on their backs, much after the same manner as packs are, or used formerly to be, on pack-horses."

#### KLAMATH-INDIAN DOG.

*Characters.*—A medium-sized dog, with a short, bushy tail.

*Distribution.*—So far as known, this peculiar breed was found only among the Indians in the Klamath River region of Oregon.

*Remarks.*—The only mention of this dog that I have found is the following by Gibbs (Suckley and Gibbs, 1860, p. 112):

"On the Klamath is a dog of good size, with a *short tail*. This is not more than six or seven inches long, and is bushy, or rather *broad*, it being as wide as a man's hand. I was assured they were not cut, and I never noticed longer tails on the pups. They have the usual erect ears and sharp muzzle of Indian dogs, but are (what is unusual with Indian dogs) often *brindled gray*."

Presumably the shortened tail arose as an independent variation among dogs of the Plains-Indian Dog type and was preserved among these dogs through selective breeding. Similar short-tailed breeds are well known among European dogs, as in the English Sheep-dog, and certain varieties of Bull-terriers. MacFarlane (1905, p. 696) gives an account of a very much prized Eskimo Dog he owned in the Mackenzie District, that was born tailless and undersized, but proved an excellent sled-dog.

## SHORT-LEGGED INDIAN DOG.

## Plate 5, fig. 1.

1829. *Canis familiaris* var. *d. novae caledoniae* Richardson, Fauna Boreali-Amer., 1, p. 82.

(?) 1912. *Canis familiaris, minor* Indian dog, Loomis and Young, Amer. journ. sci., ser. 4, 34, p. 26, fig. 4, D.

*Characters*.—Ears erect, head large in proportion, and body long; the legs relatively short but not distorted as in our Turnspits. Fur of the body short and sleek, that of the tail longer. This is possibly a derivative of the Common or Larger Indian Dog.

*Distribution*.—It is hardly possible to trace the former distribution of this type of dog. It was found by Richardson in southern British Columbia, and a dog apparently similar is known from Quebec, and perhaps formerly in New England and New York. Probably it was found among canoe-using or forest-living tribes in the North, hence was infrequent or absent in plains country.

*Notes and Descriptions*.—Apparently Richardson (1829) was the first to take special note of this breed. He found it among the Attnah or Carrier Indians of "New Caledonia," (now British Columbia) and it seems to have been bred as well by neighboring tribes as far south at least as northern California. For Gibbs (Suckley and Gibbs, 1860, p. 112) makes particular mention of seeing "one peculiar looking dog on Eel River, in the interior of northern California, among very wild Indians. It had *short* legs and long body, *like a turnspit*." Suckley in the same work, briefly says that "the Indian dogs about the Dalles of the Columbia [Oregon] are so varied in appearance that no *special* description can be given. We might, however, make two types. The *large* \* \* \* and the *small*, resembling the '*turnspit kind*' of which Mr. Gibbs speaks. The latter are generally white, or spotted liver and white, or black and white. This kind is kept more as a playmate for the children and a pet for the women."

It is significant that Suckley mentions the "varied" appearance of the Oregon dogs, so that it was possible to refer them in general to but two types. This may have been a result in part of the interbreeding of the larger and the smaller types, and in part perhaps of a mixture as Suckley suggests with European breeds already introduced.

Although generally associated with the Indians of British Columbia and neighboring parts of the northwestern United States, it seems likely that this or a similar breed may have been much more widely distributed over northern North America, as far east and south as Quebec, New England, and New York, if not farther. An excellent photograph given me by Mr. W. B. Cabot (Plate 5, fig. 1) was obtained a few years since among the Bersimis Indians, Quebec, and seems to represent a dog of the same general type. The large head, erect ears (somewhat laid back in the photograph), long, heavy body, short, straight legs, up-turned tail, agree well with other descriptions. This particular individual has the spiritless air of an old dog.

That this breed of dog was found at least as far south as the southern coast of New England, may possibly be inferred from the account by Livermore (1877, p. 58) of the dogs of the Block Island Indians, of Rhode Island. This isolated colony of Indians numbered some 300 individuals up to the year 1700, but by 1774 was reduced to only 51. In 1876, there was known to be but a single one living on the island. According to the author just mentioned, "the 'dogs' of Block Island belonging to the Manisseans before the English came have their descendants here still, it is believed. They are not numerous, but peculiar, differing materially from all the species which we have noticed on the mainland, both in figure and disposition. They are below a medium-size, with short legs but powerful, broad breasts, heavy quarters, massive head unlike the bulldog, the terrier, the hound, the mastiff, but resembling mostly the last; with a fierce disposition that in some makes but little distinction between friend and foe." The description here given, unsatisfactory though it be, implies a dog much like that shown in fig. 1, Plate 5.

*Skeletal Remains.*— I am unaware of the existence in any museum, of bones that may be definitely associated with the Short-legged Indian Dog. But, as pointed out by Loomis and Young (1912), there are in the prehistoric shell-heaps of the New England coast remains of a larger and a smaller Indian Dog, the latter of which on the strength of the evidence just given as to the former presence of the short-legged breed in eastern Canada and New England, may tentatively be referred to this animal. The authors mentioned have characterized the lower teeth of this smaller dog on the basis of jaws from the Maine shell-heaps and through the kindness of Professor Loomis I have had opportunity to study the specimens.

The mandibles are all more or less broken, but include several in fairly good condition. They differ from those of the Larger or Com-

mon Indian Dog in the smaller size of the individual teeth as well as in the shorter tooth-row. Yet the contrast is not always very striking and no doubt there was more or less intercrossing of the two types. The teeth of the smaller dog are usually more close-set than those of the larger, and on comparison, the carnassial tooth is seen to be decidedly smaller, its metaconid sometimes quite obsolete, and with a distinct tendency for the outer of the two cusps of the heel (hypoconid) to become enlarged and trenchant. As in the Common Indian Dog, and in American aboriginal dogs generally, it is common if not usual, for the first lower premolar to be lacking, and the same is frequently true of the first upper premolar. Such an anomaly is occasional in all domestic dogs. Indeed, Bourguignat (1875) founded his genus *Lycorus* on such a fossil canid jaw — probably of a wolf — from a cavern-deposit in France. In his specimen the first premolar was lacking in each ramus.

Measurements of the lower jaws and fragments of upper maxillae	Me. Flaggs.	S 1	985	1209	C 1	C 2	183
Greatest length of lower carnassial	—	19.8	20.3	21	20	20.6	21.3
Number of lower premolars	—	3	3	3	3	3	4
Alveolar length $p_2$ to $m_2$	—	65.5	—	68 †	65	64	66
" " $p_2$ to $p_4$	—	33	31.5	34	32.5	32	33
Alveoli, upper $p^1-m^2$	39.5	—	—	—	—	—	—
" " $p^4-m^2$	29	—	—	—	—	—	—
" " $m^1-m^2$	16	—	—	—	—	—	—
Greatest length of $p^1$ (tooth)	17.3	—	—	—	—	—	—

Loomis and Young (1912) mention similar small jaws from Indian sites in Arkansas.

Of limb-bones referable to the Short-legged Dog it is particularly desirable to obtain specimens for comparison with the other breeds. Among limb-bones in the Amherst collection from Maine are several longer and shorter. The latter in the lack of evidence to the contrary, may be regarded as having come from the present type. Of two humeri, one is nearly perfect and appears to be that of an adult animal, with its epiphyses thoroughly fused to the shaft. Its ole-

cranial perforation is large and oval, somewhat less than half the breadth of the shaft at the same point. The deltoid ridge is typically prominent. The bone itself is slender and not in any way thickened or distorted. It measures:—greatest length, 130 mm.; antero-posterior diameter of head, 31; transverse diameter of head, 25; transverse diameter of distal end, 25.5; width of distal articular surface, 17. It is thus about three quarters the length of the humerus in the Larger or Common Indian Dog, proportionally slender, yet considerably longer than that of the Techichi. What is undoubtedly the radius of the same dog, measures 129 mm. in greatest length; 14.5 in diameter at the proximal and 19 at the distal end. A femur, possibly of the same specimen measures:—greatest length, 136 mm.; greatest transverse width of distal end, 25. It is thus slightly longer than the humerus, in the normal proportion. The limb-bones indicate a dog about the stature of a terrier or a basset-hound.

Among many isolated lower jaws from Maine shell-heaps are some in which the carnassial tooth is noticeably narrow and intermediate in size between that of the typical Short-legged Dog and the Larger or Common Indian Dog. These probably represent cross-bred animals as Loomis and Young have suggested.

*Uses.*—These smaller dogs were apparently the familiar household pets or hunting companions of the Indians of forested country or of the canoe-using tribes. They were too small to be of service as pack-animals with *travois* or *pannier*, and hence seem not to have been much in favor with the Plains Indians, whose main subsistence was the Bison for the hunting of which, dogs were unnecessary. Suckley (1860) particularly mentions that they were kept more as a "play-mate for the children and a pet for the women" among the tribes of the Columbia River. Moreover, a small dog is a better companion in a canoe than a larger clumsy animal.

Richardson says of the Short-legged Dog, that it was used in the chase, was very active and agile at jumping. It was perhaps a dog of this type that was used in hunting the beaver. George Bird Grinnell (Forest and stream, 1897, 49, p. 382) writes that the Cheyenne Indians, before their intercourse with whites, hunted the Beaver with dogs, by breaking the dam and thus exposing the beaver houses and their underwater entrance. "The dogs which were small enough to enter this hole, and yet were pretty good sized animals, went into the hole" and worried the beaver till it followed the dog out, when an Indian waiting outside, clubbed the beaver to death. Le Jeune, in his *Relation de ce qui c'est passé en la Nouvelle France* [Quebec]

en l'anné 1633 (Jesuit relations, 1897, 5, p. 165) mentions this use of dogs in Beaver hunting; "sometimes when the dogs encounter the Beaver outside its house, they pursue and take it easily; I have never seen this chase, but have been told of it; and the savages highly value a dog which scents and runs down this animal." Le Jeune speaks of the familiarity of the Indian dogs, that in winter they are unable to sleep outside and come into the cabins, lying and walking over the inmates. Elsewhere he speaks of giving food to a 'petit chien,' but adds that "the savages do not throw to the dogs the bones of female Beavers and Porcupines,—at least certain specified bones....yet they make a thousand exceptions to this rule, for it does not matter if the vertebrae or rump of these animals be given to the dogs, but the rest must be thrown into the fire."

Testimony of early travellers is somewhat conflicting as to the eating of their dogs by the Indians. Le Jeune states that "in the famine which we endured, our savages would not eat their dogs, because they said that, if the dog was killed to be eaten, a man would be killed by blows from an axe." On other occasions, however, such scruples were not observed. Thus Father Rasles, in a letter written to his brother in 1716, from Narantsook, forty miles up the Kennebec River, Maine, says that at the news of the French and English War, the Indian young men were ordered by the older Indians to kill dogs for the purpose of making the war-feast (Jesuit relations, 1897, 67, p. 203) — possibly here with a view to sending their dogs on before, should death overtake their masters. Feasts of dog-flesh seem to have been commoner among the Indians of the West and South, and Fremont in his narrative of his explorations (1845, p. 42) recounts being invited, as a mark of honor, to a dog-feast. "The dog was in a large pot over the fire, in the middle of the lodge, and immediately on our arrival was dished up in large wooden bowls, one of which was handed to each. The flesh appeared very glutinous, with something of the flavor and appearance of mutton. Feeling something move behind me, I looked round, and found that I had taken my seat among a litter of fat young puppies."

Harmon, writing in 1820, after nineteen years spent in travel through the Northwest from Montreal to the Pacific, speaks of the smaller dog used in hunting, and a larger dog as well. The latter is rank and not good eating like the former, of whose flesh the Indians and French Canadian *royageurs* were very fond.

In the New England shell-heaps, the dog-remains occur either as burials — the entire skeleton undisturbed — or as scattered portions,



as if the bones had been thrown out after the flesh was eaten. There seems, however, to be little or no evidence that the bones were cracked for marrow.

The Jesuit father Biard in 1616, mentions dogs, kettles, and axes as among the presents given by a young Indian to the father of his intended bride in payment for her. Among other customs of the Indians of Arcadia, he recounts that at a funeral, dogs are presented the dying man, as well as skins, arrows, and so forth. The dogs are then killed in order to send them on before him to the other world, and their flesh is later eaten by the people (Jesuit relations, 1896, 3, p. 101).

#### CLALLAM-INDIAN DOG.

##### Plate 4, fig. 1.

1840. *Canis laniger* Hamilton Smith, Jardine's Nat. library. Mammalia, 10, p. 134.

1867. *Canis domesticus, camtschatkensis longipilis* Fitzinger, Sitzb. K. akad. wiss. Wien, 56, pt. 1, p. 406.

*Characters.*—A medium-sized dog, with erect ears, and bushy tail. Hair rather thick and woolly; white, or perhaps brown and black.

*Distribution.*—Formerly found among the coast Indians of the Puget Sound region and Vancouver Island. Lord (1866, 2, chap. 11) asserts that these dogs seem to have first been kept by the Chinook Indians, once very numerous near the mouth of the Columbia River, and were thence carried to Puget Sound and Nainimo. The source of this information is not given, but it is worth remarking that Lewis and Clark make no mention of the breed on the Columbia. Vancouver found them near the then Port Orchard, and apparently at least as far up the Sound as Admiralty Inlet. Hamilton Smith implies that they were to be found at Nootka Sound on the west coast of Vancouver Island.

*Descriptions.*—The earliest account of this dog is that by the navigator, Vancouver (1798, 1, p. 266). In May, 1792, while at Port Orchard, Puget Sound, he writes:—

“The dogs belonging to this tribe of Indians [at Port Orchard] were numerous, and much resembled those of Pomerania, though in general somewhat larger. They were all shorn as close to the skin as sheep are in England; and so compact were their fleeces, that large portions

could be lifted up by a corner without causing any separation. They were composed of a mixture of a coarse kind of wool, with very fine long hair, capable of being spun into yarn. This gave me reason to believe, that their woollen clothing might in part be composed of this material mixed with a finer kind of wool from some other animal, as their garments were all too fine to be manufactured from the coarse coating of the dog alone. The abundance of these garments amongst the few people we met with, indicates the animal from whence the raw material is procured, to be very common in this neighborhood; but as they have no one domesticated excepting the dog, their supply of wool for their clothing can only be obtained by hunting the wild creature that produces it; of which we could not obtain the least information." Elsewhere he mentions a deer "they had killed on the island, and from the number of persons that came from thence, the major part of the remaining inhabitants of the village, with a great number of their dogs, seemed to have been engaged in the chase," this near Admiralty Inlet. Farther up Puget Island,  $48^{\circ} 2\frac{1}{2}'N$ ,  $237^{\circ} 57\frac{1}{2}'W$ , at a large village "they were met by upwards of two hundred [Indians], some in their canoes with their families, and others walking along the shore, attended by about forty dogs in a drove, shorn close to the skin like sheep [this in June]" (*Ibid.*, p. 284).

Hamilton Smith (1840) who, in addition to Vancouver's account, had information from an Indian who had resided two years at Nootka, speaks of it as a large dog, "with pointed upright ears, docile, but chiefly valuable on account of the immense load of fur it bears on the back, of white, and brown, and black colours, but having the woolly proportion so great and fine, that it may well be called a fleece."

Notwithstanding Smith's assertion as to the "brown and black colours" of this dog, it is not at all certain that this was the usual case. Suckley (1860, p. 112) says positively that "all the Clallam dogs that I saw were *pure white*; but they have the sharp nose, pointed ear, and hang-dog, thievish appearance of other Indian dogs." Gibbs also (*Ibid.*) mentions their whiteness only, and adds that the very soft hair is sheared like the wool of sheep, and made into blankets, though at that time, 1860, it was "generally intermixed with the ravellings of old English blankets to facilitate twisting with [?into] yarn."

Lord (1866) further remarks that this white, long-haired dog was kept by only a few coast tribes near Vancouver. The dogs were confined "on islands to prevent their extending or escaping," and it differed "in every specific detail from all the other breeds of dogs

belonging to either coast or inland Indians." He supposes it to be of Japanese origin, recalling the long-haired Japanese Lap-dog, which however, seems remote enough in other characters. Lord adds that in the manufacture of rugs from the hair of this dog, the Indians often added the wool of the Mountain Goat, or duck feathers, or wild hemp. They dyed the hair as well. He obtained several of these blankets along the coast for the British Museum. Newcombe (1909, p. 50) gives a further account of the method of making yarn from the hair, which he says, was removed from the dried skin of the dog with knives or pulled out after moistening the hide and "sweating" the hair to loosen the roots. The wool was then made into loose threads by rolling. With the introduction of Hudson's Bay Company blankets this industry has ceased and the dog was practically extinct at the time of his writing.

As to the origin or affinities of this breed, little can be said. Some writers have classed it with the Siberian and Eskimo dogs, but it is likely that it was a breed of the larger type of Indian dog. The disinclination to take to water, made use of by the Indians to confine the animals to islands, is a trait shared by the Eskimo Dog. The precaution was possibly taken in order to prevent crossing with other breeds of Indian Dogs.

Windle and Humphreys (1890) in their table of cranial proportions of Eskimo Dogs, include those of a Nootka Dog in the British Museum. It is not clear, however, if it was from a dog of the breed under consideration, and as no actual dimensions are given, the figures are not comparable with other direct measurements.

I am indebted to Mr. C. T. Currelly, Curator of the Royal Ontario Museum of Archaeology at Toronto, for a photograph (Plate 4, fig. 1) of the unique painting made at Victoria, B. C., in 1846, by Paul Kane and now at that Museum. In the foreground is one of the white woolly dogs in question, its apparently erect ears nearly hidden in the long hair of the head. Nearby an Indian woman is weaving a blanket, no doubt from yarn made of dogs' hair, a ball of which another woman in the background is spinning. The use of dogs' hair in making blankets is not confined to the Clallams. The ancient Zuni appear to have made similar use of it; and Bannister (1869) mentions an Indian blanket from Mackenzie River, woven of dogs' hair. The natives of New Zealand regularly employed dogs' hair for braiding and ornament.

## INCA DOG.

## Plate 9.

1844. *Canis ingae* Tschudi, Unters. über die fauna Peruana. Therologie. p. 13, 249.

1885. *Canis ingae pecuarius* Nehring, Sitzb. Gesellsch. naturf. freunde Berlin, p. 5-13.

*Characters.*— This is the larger dog of the ancient Peruvians. It was about the size of a small Collie, but more heavily proportioned. Tschudi describes it as having the head small, snout rather sharply pointed, upper lip not cleft; ears erect, triangular, small; body short and strong, squarely built ("untersetzt"), legs rather short; tail about two thirds the length of body, fully haired and curled forward. Pelage rough, long, and thick; color dark ochre-yellow with dark wavy shadings; belly and inner side of limbs somewhat brighter than the ground color of the back. No light spots above the eyes.

The skull is heavy in proportion to its size, with a narrow rostrum. The brain-case is rugose for the attachment of muscles, yet the temporal muscles, even in old dogs seem to little more than meet medially, so that at most only a low sagittal crest is formed in old animals except at the extreme occiput, where it is contrastingly marked, forming a high knife-edge on the median line of the interparietal. The palate shows a strong thickening at its posterior end, forming two low ridges one on each side between the last molar and the posterior narial opening.

*Distribution.*— The former distribution of this breed has not been definitely traced. Mummified remains are known from Ancon, Peru, and from various sites that have been excavated in that country. In Tschudi's time it appeared to be confined to the upland tribes of Indians. Of this type were all the mummies and skulls of dogs found by him in the ancient graves among the Sierras. It probably was kept by the Indians of northwestern Argentina as well.

*Nomenclature.*— Tschudi in 1844, was apparently the first to name this as a distinct breed of dog, *Canis ingae*. Forty years later Nehring in writing of the dog-mummies from the ancient necropolis of Ancon, referred it to a collie-like type with the combination, *Canis ingae pecuarius*. It is, however, very different cranially and otherwise from the Collie.

*Measurements.*— The largest Inca Dog among those from Ancon

studied by Nehring (1884a) was smaller than a Sheep-dog, with a skull about 172 mm. long, humerus 147, ulna 172, radius 140. A smaller one had a skull length of 165, head and body 660, tail including hair 240, humerus 130. In the lower jaws the first premolar was frequently missing.

The following table gives measurements of the six largest skulls among a series of nine belonging to the U. S. N. M.

Measurements of the Skulls	172,888	172,859	176,310	172,858	176,396	176,309
Length, (occiput to anterior base of incisors)	155	164	160	163	172	178
Basal length	139	145	146	144	151	159
Palatal length	78	81	81	79	84	86
Orbit to tip of premaxillary	63	69	66	68	72	75
Upper tooth-row	83	—	84	—	—	93
“ “ (alveoli)	80	84	82	82	85	89
Front of canine to back of molar <sup>2</sup> (crowns)	65	—	69	—	—	76
Front of canine to back of molar <sup>2</sup> (alveoli)	64	68	67	67	69	74
Length of premolar <sup>4</sup> (crown)	16.5	18	17	17.5	17.5	19
“ “ “ (alveolus)	16	17	16	16.5	17	17
“ “ molars <sup>1-2</sup> (crowns)	17	—	17	—	18	19
“ “ “ (alveoli)	15.5	17	15	16	16.5	17
Zygomatic width	92	99	98	96	108	107
Breadth of occipital condyles	32	34	33	32	34	35
Median length of nasals	48.5	—	51	52	55	56

*Remarks.*— Writing about 1844, Tschudi describes the chief characteristics of this dog as treachery and mischievousness. Every Indian hut and shepherd of the Sierra and puna had several. They seemed to show a special antipathy toward white people. A European traveller approaching an Indian hut on horseback would be beset by these dogs springing up against his horse to bite his legs. They are courageous, and fight an enemy with determination, dragging themselves to the attack even when mortally wounded. The Indians train them to track and capture tinamous.

In their great work on the Necropolis of Ancon, Reiss and Stübel include a brief chapter by Nehring (1884b) on the mummified remains of dogs discovered there. Some of these are figured and show a pale

yellowish coloring with darker areas. In a more extensive article Nehring (1884a) gives a particular account of the dogs of Ancon. He first transcribes passages from Garcilasso de la Vega to show that the Incas had dogs previous to the Spanish conquest, and that the dog entered into certain religious rites of the Incas. A mummified dog is described as having thick hair, shorter, however, on head and feet, thickest on neck and breast forming a kind of mane. The color was yellow, clear or soiled in places, with irregular brown-shaded areas. The tail was thick and bushy, wolf-like, also yellow. The ears of most of the specimens seemed to have been clipped. He suggests the North American Wolf or Coyote as the original source of the Inca dogs, but there seems no ground for the selection of either as an immediate ancestor.

More recently, Eaton (1916, p. 25) has recorded the discovery of dog-mummies with pre-Columbian burials at Machu Picchu, Peru. He adds that "dogs of this general type, though usually a little smaller than those figured in Reiss and Stübel's Necropolis of Ancon, were frequently seen in the parts of the Cordillera that I visited, and these animals may be largely derived from the ancient stock. . . . The modern Indian dogs of this ancient type are very wolf-like and manifest a most inconvenient fear of the camera." He suggests the obvious possibility of present-day mixture with breeds imported from Europe, and gives a reproduction (p. 50, fig. 47) of a photograph showing dimly an Indian with his dog.

The fine series of Peruvian dog-skulls in the U. S. N. M. contains nine that show complete gradation in size between the smallest (which I have considered more or less typical of the Techichi) and the largest which represents the Inca Dog. Since these skulls are more or less comparable as to age, it seems likely that the gradation in size is due to free interbreeding of the two sorts of dogs. The largest skull of the series (U. S. N. M. 176,309, of which the measurements have been given) is almost precisely matched by the skull of a Common Indian Dog from Peel River, Arctic America, collected by Robert Kennicott about 1860 (U. S. N. M. 6,219). The only obvious differences are that the palate of the Inca Dog shows the peculiar thickened ridges at the posterior end and is much narrower across the occipital condyles. The latter characteristic is shared by the other dog-skulls from Peru in contrast with the northern dogs, and is no doubt among the latter a result of their use as sledge-dogs, for the greater development of the neck and chest muscles in hauling might well enough demand a broader support from the skull. This general similarity

of skull and skeletal proportions probably indicates a closer relationship with the larger Indian dogs of northern North America, than with the Wolf or Coyote as Nehring has suggested.

What may be feral dogs of this breed are said to be found in the Island of Juan Fernandez, off Peru. According to Ermel (1889, p. 53) they are the native Araucarian dogs, shaggy-coated, of medium size, and very powerful. Semitamed ones are sometimes used there in hunting the feral goats.

Ihering (1913) has recorded the discovery of an entire skeleton of a dog at Hualfin, Salta Province, in northwestern Argentina. Its skull measurements, as recorded by this author, correspond well with the larger of those above given, and his identification of the specimen as an Inca Dog is probably correct.

#### LONG-HAIRED INCA DOG.

*Characters.*—Apparently similar to the Inca Dog, but with longer coat.

*Distribution.*—Peru and probably coastwise to parts of Chile.

*Notes.*—In his Bibliography of the tribes of Tierra del Fuego and adjacent territories, Cooper (1917, p. 44) mentions "a breed of long-haired shaggy dogs" which was formerly raised among some of the Chonos Indians north of the Taitao Peninsula, Chile, about Lat. 45° South. Nothing is known about these dogs except the statements of Goicueta and Del Techo, based perhaps on independent testimony. It is assumed that this breed was of native origin since at that early date (about 1553) it is rather unlikely that such dogs would have been obtained from Europeans. Possibly they were derived from the larger collie-like type of Inca dog anciently found among the Peruvians (Eaton, 1916, p. 49). From the hair of these dogs, the Chonos made short mantles that covered the shoulders and upper part of the trunk. According to Cooper, the information of Goicueta is based on the relation of Cortés Hojea's expedition of 1553-54, when he commanded one of the vessels under Ulloa, and possibly also furnished one of the sources for Del Techo's account. The latter was a Jesuit missionary who wrote in 1673 concerning the labors of his brethren among the Chonos of the Guaitecas Islands.

Referable to this breed is probably the long-haired dog described by Nehring (1887a) from a well-preserved mummy found in the course of excavations at Ancon, Peru. It was found wrapped in cloth of

tree-wool, its head and feet tied together. In the size of its skull and leg-bones it was said to be like the ordinary Inca Dog of the collie-like type, but clothed with unusually long hair, especially on the feet and tail. The hair is described as of a dull yellow. This dog must have been very similar to the Long-haired Pueblo Dog previously mentioned as discovered by Messrs. Guernsey and Kidder in excavations at Marsh Pass, Arizona.

#### PATAGONIAN DOG.

*Characters.*—A medium-sized dog, as big as a large Foxhound, coat usually short and wiry, or longer and of softer texture; ears short and erect; color dark, more or less uniform, rarely spotted; dark brownish black, dark tan, or occasionally black; tail bushy. General appearance like a small Wolf.

*Distribution.*—Found among the Foot Indians of the eastern parts of Tierra del Fuego, northward into Patagonia, the northwestward limits of distribution not clearly known.

*Remarks.*—Hamilton Smith (1840, p. 213) quotes a letter from Captain Fitzroy of the BEAGLE, that the Patagonian Dog is strong, about the size of a large Foxhound, coat short and wiry, though sometimes soft and long, like that of a Newfoundland Dog. In color it is dark, nearly uniform, rarely spotted. It is wolfish in appearance, somewhat resembles the Shepherd Dog, will growl and bark loudly.

It is doubtless a dog of this breed that is meant by Furlong in his statement that of the two types of dogs found among the Onas of Tierra del Fuego, one is like a Wolf.

Cunningham (1871, p. 307) mentions that while near Gente Grande Bay, Sandy Point, in the Strait of Magellan, three dogs wandered about in the neighborhood of his landing party, "barking and howling dismally. The first was very much like a fox in size and general appearance, and of a reddish-gray colour; the second had a piebald smooth coat, with drooping ears; while the third was clothed with long dark brownish-black hair, had erect ears, and presented a marked resemblance to a small wolf." The first was probably a Fuegian Dog, obtained through intercourse with tribes of the western part of the Magellanic Archipelago; the second was possibly a mongrel European dog; the last perhaps a Patagonian Dog.

Of this animal, Spegazzini (1882, p. 176) writes that it differs greatly from the Fuegian Dogs of the Canoe Indians, "y para mí serian 6



cruxa ó descendientes directos del lobo-colorado ó gran zorro-colorado." It is difficult, however, to see any ground for deriving it from the peculiar Pampean Wolf. It is much larger than the Fuegian Dog, and is described by Spegazzini as tall, slenderly built, with fierce eyes; long-haired and bushy-tailed; the color prevailing dark tan, but occasionally black; rather silent, not barking though giving voice to melancholy howls.

Fitzroy (see Hamilton Smith, 1840, p. 215) particularly describes a dog seen near the Strait of LeMaire. No temptation would induce its master to part with it. It was the size of a large setter, with a "wolfish appearance about the head, and looked extremely savage. Behind the shoulders it was quite smooth and short-haired, but from the shoulders forward it had thick rough hair," giving it a lion-like appearance, "of a dark grey colour, lighter beneath, and white on the belly and breast; the ears were short but pointed, the tail, smooth and tapering;" the fore quarters very strong but the hinder appearing weaker. The short-haired tail seems unnatural for a Patagonian Dog, and may have been evidence of a strain of blood from a European source.

The eastern Fuegians or Onas, are considered by ethnologists to be derivatives of the Patagonians, and no doubt originally had these dogs from their mainland relatives, or brought them at the time when they colonized the Fuegian country.

It is unfortunate that no bones or figures of the Patagonian Dog are available for comparison. Ihering (1913) has, however, recorded the skull of a prehistoric dog from Amaicha, Tucuman province, northwestern Argentina, which may represent it, and at the same time indicate nearly its northern range. This skull was 190 mm. in total (?occipitrostral) length, the upper fourth premolar 19 mm., the combined upper molars 20 mm., hence a somewhat larger breed than the Inca Dog.

The native Patagonian Dog is not to be confused with the dogs introduced by Europeans, that have since become feral on the pampas of southern South America. These, according to various writers (Rengger, 1830; Hamilton Smith, 1840; Rasse, 1879) are mongrel of several breeds, notably one like the Great Dane. They are said to go in troops and to make burrows in which to shelter their young. This burrowing habit has been noticed in case of other feral dogs. Thus Coues (1876) records the case of a brindled cur that became feral, and took up its habitation in a burrow on the open prairie, near Cheyenne, Wyoming, and in this den had a litter of five puppies.

Fitzinger (1867, p. 397) applies to the feral Pampean Dog the Latin combination "*Canis domesticus, pyrenaicus albo*" (1) and briefly states that it is probably a hybrid between the Pyrenian Dog and the Bulldog. Hamilton Smith (1840) had previously described it under the Latin name *Canis campivagus*.

As to the origin of the Patagonian Dog, there is little satisfactory evidence, but it may be assumed to be a derivative of the same stock as the Inca Dog. The tooth measurements of the skull recorded by von Ihering (1913), cf. p. 477, accord very nearly with those of the largest Inca Dog of our table (p. 473), though even larger.

#### MEXICAN HAIRLESS DOG; XOLOITZCUINTLI.

##### Plate 2; Plate 3, fig. 2.

- 1651. *Lupus mexicanus* Recchi and Lynceus, *Rerum medicarum Novae Hispaniae thesaurus*, p. 479, fig.
- 1766. *Canis mexicanus* Linné, *Syst. nat.*, ed. 12, 1, pt. 1, p. 60, (based on Recchi and Lynceus).
- 1788. *Canis familiaris aegyptius* Gmelin, Linné's *Syst. nat.*, ed. 13, 1, pt. 1, p. 68 (in part).
- *Canis familiaris orthotus xoloitzcuintli* Reichenbach, *Naturg. raubth.*, p. 150.
- 1821. *Canis nudus* Schinz, *Cuv. thierreichs*, 1, p. 218.
- 1827. *Canis familiaris caraibaeus* Lesson, *Man. mammalogie*, p. 163.
- 1844. *Canis caraibicus* Tschudi, *Fauna Peruana, Therologie*, p. 249.
- 1887. *Dysodus gibbus* Cope, *Amer. nat.*, 21, p. 1126.

*Characters*.—A dog of medium-size, rather heavily built, and long-bodied in proportion to its height; ears large and erect; tail thick, drooping or carried nearly straight behind; hair nearly absent except for a few coarse vibrissae and generally a sparse coating on the tail, particularly near the tip; sometimes a tuft on the crown. The skin is usually pigmented, a slaty gray, or reddish gray, paler in the bends of the legs; sometimes blotched with white.

*Distribution*.—This race seems to have been native among the peoples of Central and South America from Chihuahua perhaps continuously southward, to the Peruvian lowlands, and in some of the Greater Antilles; it may also have been indigenous among the Indians of Paraguay.

*History*.—The first account of the Mexican Hairless Dog by a

European, seems to be that of Francisco Hernandez, who lived between the years 1514 and 1578. His *Historia Animalium et Mineralium Novae Hispaniae*, is printed on 96 folio pages as part of Recchi and Lynceus's *Rerum Medicarum Novae Hispaniae Thesaurus*, 1651, which was apparently intended as a monographic elaboration of Hernandez's work. This writer brought back an account of three sorts of dogs, which were in his day kept by the native Mexicans. The first of these he had himself seen, but the two others he had neither seen, nor known of their having been brought to Europe. This first sort he states, is called the *Xoloytzcuintli* and is larger than the others, exceeding three feet in body length, but with the peculiarity of having no hairy covering, yet with a soft skin, spotted with fulvous and slate color. ("Primus Xoloytzcuintli vocatus alios corporis vincit magnitudine, quae tres plerum; excedit cubitos, sed habet peculiare nullis pilis tegi, verum molli tantum, ac depili cuti, fuluo atque Cyaneo colore maculata."). The two other sorts of dogs were the hump-backed or Michuacan dog and the Techichi, elsewhere discussed. The *Xoloytzcuintli* of Hernandez is clearly the Hairless Dog, and a most elaborate account of the animal is given by Recchi and Lynceus (1651, p. 479 ff.) with a fairly recognizable figure (Plate 2, fig. 1). These authors apparently had an actual specimen, possibly one brought alive to Europe; at all events they describe its appearance as fierce and wolf-like, with a few bristly hairs about the mouth, the mammae ten as in the wolf and dog, and the vertebrae of the same number as in a dog-skeleton with which they compared it, namely seven cervicals, thirteen dorsals, seven lumbosacrals, seventeen caudals. They name the animal *Lupus mexicanus* in contradistinction to their Alco or *Canis mexicana*, which was probably a Raccoon. This name appears in zoological nomenclature in the twelfth edition of Linné's *Systema naturae* under the genus *Canis*. The diagnosis, evidently based on the figure and description just noticed, reads: "*C. cauda deflexa laevi, corpore cinereo fasciis fuscis maculisque fulvis variegata*"; the habitat is given as the warmer parts of Mexico. Linné's first reference is to Brisson, whose description — "*Canis cinereus, maculis fulvis variegatus*" — is clearly from the same source. Hitherto Linné's *Canis mexicanus* has been regarded as applying to the wolf of Southern Mexico, but no true wolf is known from that part of the country. Miller (1912a) seems to have been the first to question the propriety of using the name for a wolf, but leaves the matter unsettled, saying that according to E. W. Nelson, "the wolf of the southern end of the Mexican tableland became extinct

about fifty years ago" (1860). Some other name must therefore be applied to this wolf if it ever be shown to be distinct.

The above accounts by Hernandez and by Recchi and Lynceus are the basis of most of the earlier references to the Mexican Hairless Dog. Lesson, in 1827, however, redescribed it under the name *caraibaeus*, and Gmelin, earlier, 1788, had considered it the same as the Turkish or Egyptian Hairless Dog, under the name *Canis f. aegyptius*; this however, is a hairless variety of another breed.

*Notes.*—The former distribution of this remarkable dog is now hardly traceable with certainty except in a general way, but it was kept by the Mexicans of Chihuahua and southward, as well as by the natives of Peru, more especially those of the lower altitudes. According to Seler (1890) the Mexicans wrapped these dogs in cloths at night as a protection against cold. Some were not naturally hairless, but were rubbed with turpentine from early youth, causing the hair to fall out. On the other hand, dogs naturally hairless were raised, as at the pueblos Teotlixco and Tocilan. The Zapotec and Maya languages have separate words for the hairless dog. The term *xoloitzcuintli* is said to signify the monstrous dog. Patrick Browne (1789, p. 486) writing of the natural history of Jamaica, mentions the Indian dog as "*Canis pilis carens, minor*," a creature "frequent among the *Jews* and *negroes*" in that island; he describes it as "generally about the size of a cur-dog with a rough skin, which looks like the hide of a hog." There is nothing to indicate, however, that the breed was common in the West Indies.

In Peru, Tschudi (1844, p. 249) observed this dog mainly on the coast, since its lack of a hairy coat made it unable to withstand the cold of the higher altitudes of the interior except in the warm valleys, and then only if carefully protected. He describes it as slaty gray or reddish gray, sometimes spotted, and says it is voiceless. He is probably mistaken, however, in supposing these were the dogs found by Columbus among the Lucayans. Nearly twenty years previously, Lesson had seen the Hairless Dog in numbers at Payta, Peru.

According to Rengger (1830), a hairless dog, possibly identical with the Mexican Hairless Dog, was indigenous among the Indians of Paraguay, who had a special word — *yagua* — for it. He describes it as having a relatively small head, pointed snout, ears erect or only their tips drooping forward, rump fat, extremities fine, tail spindle-shaped and usually drooping. Some individuals do not bark, but howl only.

During the last hundred years, little attention seems to have been

given to this breed, although lately it has been taken up by dog fanciers. LeConte, in 1856, calls it the Comanche Dog, and says it is common among the Indians of that tribe, but, "though some of these dogs have been brought within the United States, we have no description of them." Packard (1885) mentions seeing one in his visit to Mexico, but they were apparently uncommon. In a recent letter from Mr. Arthur Stockdale, he states that in Mexico City they are now considered somewhat of a rarity, though said to be common in Chihuahua, where however, little attention is paid them.

There is some evidence that they do not breed readily with normally haired dogs, yet such crosses have been made, and curiously the result seems to be that about 50% of the young are naked or practically so, the other 50% fully haired. Stockdale (1917) records such a litter consisting of two puppies, one hairless, the other normal. Kohn (1911) records a mating of a Hairless Dog with a Fox-terrier, the four offspring of which comprised two naked and two completely-haired dogs. His microscopic study of the skin of the Hairless Dog indicates that its character is that of a young embryo's, whence it may be that the hairless character is merely the retention of the embryonic condition, just as the short-nosed skull of the Japanese Lap-dog seems to be a case of the retention of the embryonic proportions of the skull.

As to the origin of this breed, it is most likely a variant of the larger type of Indian Dog, in which the hairlessness is due to a retention of the embryonic condition of the skin, precluding hair development, just as the short-nosed breeds of dogs are the result of the failure of the facial bones to attain full growth.

I have unfortunately been unable to obtain skulls for comparison.

#### SMALL INDIAN DOG OR TECHICHI.

##### Plate 10.

- 1788. *Canis familiaris americanus* Gmelin, Linné's, Syst. nat., ed. 13, 1, pt. 1, p. 66 (in part).
- 1792. *Canis americanus plancus* Kerr, Animal kingdom, 1, p. 136 (based on the Techichi of Hernandez).
- 1840. ?*Canis alco* Hamilton Smith, Jardine's Nat. library. Mammalia, 10, p. 135, pl. 4, left-hand fig.
- 1841. ?*Canis familiaris cayennensis* Blainville, Ostéographie. Atlas, pl. 71.
- 1867. *Canis carabæus, hernandesii* Fitzinger, Sitzb. K. akad. wiss., Wien, 56, pt. 1, p. 498.
- 1882. ?*Canis gibbus* Dugés, La naturaleza, 5, p. 14, fig. 1-3.

*Characters.*—A small, light-limbed dog, of rather slender proportions, narrow delicate head, fine muzzle, erect ears, well-developed tail, which may have been close-haired. Colors black, black and white, or perhaps brownish or yellowish.

*Distribution.*—This was perhaps the dog of fox-like appearance noticed by many of the early explorers, yet it is difficult to indicate the limits of its former distribution. On the Atlantic seaboard, among the considerable quantity of skeletal remains examined, I have seen nothing that could be referred to such a dog; yet Brereton, who reached the Elizabeth Islands and coast of southern New England with Gosnold in 1602, mentions "Dogs like Foxes, blacke and sharpe nosed" among the "Commodities" seen there. In the famous village site near Madisonville, southwestern Ohio, its bones occur and there are in the Peabody Museum similar bones from the southwest and Yucatan, believed equally to be pre-Columbian. Among the dog-skulls found with Peruvian burials the same type occurs, as well as skulls intermediate between this and other dogs, and so probably representing mongrel individuals. Probably then this type of dog was spread over at least the central and southwestern part of North America and parts of northwestern South America.

*Nomenclature.*—This is assumed to be the Techichi of the early Spanish accounts of Mexican dogs, though there is little doubt that two different animals as well as more than one breed of dog were confused under this title by the early writers and systematists. It is of some importance, therefore, to examine their accounts carefully since the case is somewhat complex and involves the identity of the Alco of early writers. Both Gmelin and Kerr based their names on the account of Recchi and Lynceus (1651, p. 466), who in turn refer to Hernandez's brief account (which they print), in the *Historiae animalium et mineralium Novae Hispaniae*, page 7. Hernandez who died in 1578, had visited Mexico, and in his enumeration of its animals includes three sorts of native dogs. The first of these is unquestionably the Mexican Hairless Dog, and as he himself states, was the only one he saw personally ("caeteros verò neque conspexeram, neque adhuc eo[i. e. ad Europam] delatos puto").

His account of the two other dogs is important and reads:—"Secundus Melitensibus canibus similis est, candido, nigro, ac fulvo colore varius, sed giberosus, gratusque iucunda quadam deformitate, ac capite velut ab humeris edito, quem Michuacanensem abora vnde est oriundus vocare solent. Tertius verò nuncupatus Techichi, Catulis similis est nostratibus, Indis edulis, tristi aspectu, ac caetera

vulgaribus similis. Atque hæc de canibus Nouæ Hispaniæ breuiter dicta sunt." Translated freely, "The second is like the Maltese dogs, in color varied with white, black, and fulvous, but it is hump-backed and prized for this pleasing deformity, and a head that appears to grow from the shoulders. It is called the Michuacan dog from the place where it is native. The third sort of dog, however, is called Techichi, and is like our Spaniels, but of sad countenance, though in other respects like ordinary dogs. It is eaten by the Indians. This then is briefly what I have to say of the dogs of Mexico." The Techichi apparently was in no wise peculiar as a small dog. The Michuacan animal, however, was hump-backed, without conspicuous neck, its colors white, black, and fulvous, "varius." In their elaboration of Hernandez's account, Recchi and Lynceus (1651, p. 466) fail to distinguish between these two supposed dogs; at all events their figure (Plate 3, fig. 1) and description deal altogether with the hump-backed animal, of which they seem to have had some knowledge or probably a preserved specimen. They figure a female under the name '*Canis Mexicana*' and the Mexican name *Ytzcuinteporzotli*, the first half of which signifies 'dog.' Buffon, and later Gmelin, likewise failed to distinguish between Hernandez's second and third sorts of dogs, and the latter author in 1788, combined the two under the name *Americanus*, with a brief diagnosis based on the figure of Recchi and Lynceus, viz., "magnitudine  $\iota$  [i. e. of the breed *melitæus*], capite parvo, auribus pendulis, dorso curvato, cauda brevi." Under this name, Gmelin included: a. *Ytzcuinteporzotli*, or the *Canis mexicana* of Recchi and Lynceus and b. Techichi of Hernandez. Obviously the diagnosis applies to the hump-backed animal only, to which Buffon had already applied the native name Alco, following Recchi and Lynceus. This name appears to have been of doubtful application to the common dog, but was used at times by later writers to indicate the small native dog of Peru and Mexico. Kerr (1792, p. 136) endeavors to improve on Gmelin by distinguishing with Latin names the two varieties of the latter's *Canis americanus*. He first transcribes the description and then distinguishes: "a. Fat Alco. — *Canis americanus obesus*" and "b. Techichi. — *Canis americanus plancus*," with descriptive accounts from Hernandez and his elaborators, corresponding to Gmelin's "a" and "b."

What then was this Alco? A study of Recchi and Lynceus's figure (Plate 3, fig. 1) and description seem to indicate clearly that they had in mind a Raccoon. They describe its nose, forehead, and eyebrows as white, these markings evidently delimiting the dark face,

while the peculiar and characteristic upward slope of the back in the live animal is thus described: "Dorsum cameli instar gibbosum, post collum subito ad pectus acclive, sed coxas versus declive." The tail is said to be short, barely reaching the heel, the mammae six in number. They further note its very fat belly, beautifully covered with thick black hair varied with spots; feet and shanks whitish, claws strongly exerted. These characteristics recall the Raccoon more than any other animal. There are, however, eight mammae in this animal, and the ears are not pendulous as described, but these discrepancies may be due to inaccuracy of observation, or the condition of the specimen (perhaps a preserved hide) which the authors seem to have had. The account quoted from Acosta (1590, p. 277) doubtless refers to the same animal and not to a dog. This author, in his *Historia natural y moral de las Indias*, writes:—"Verdaderos perros no los auia en Indios, sino unos semejantes a perrillos, que los Indios llamauan Alco: y por su semejana a los que há sido lleuados de España, tambien los llaman Alco: y son tan amigos destos perrillos que se quitaran el comer, por darselo: y quando van camino, los lleuan consigo acuestas, o en el seno." (Of real dogs there are none in the Indies, save certain animals resembling little dogs, which the Indians call Alco; and on account of their resemblance to our dogs brought here from Spain, the Indians call these Alco as well: and so fond are they of their little dogs that they deny themselves of food in order to give it to them; and when they go on a journey they carry the little dogs with them on their shoulders or in their arms). The Raccoon rather than a small dog seems to be indicated here, and the habit of carrying them about on journeys would perhaps account for the present-day anomalous distribution of the small species of raccoon in Central America (Panama) and in the islands of Cozumel, Guadeloupe and New Providence. Acosta's story may also explain the transference of the name Alco to small dogs, though Philippi (1886) says this means dog in the Quichua tongue.

An early mention of the tame Raccoon is found in Hakluyt's *Voyages*, in a relation of the commodities of Nova Hispania, and the maners of the inhabitants, written by Henry Hawkes merchant, which lived five yeeres in the sayd countrey, written in 1572. He says: "Their dogs are all crooked backt, as many as are of the countrey breed, and cannot run fast: their faces are like the face of a pig or a hog, with sharpe noses."

If Gmelin's name *americanus* be admitted as applying to a Raccoon it would antedate Wagler's name *hernandezii* (1831) for a Mexican



Raccoon. In view, however, of the uncertainty as to which form of Raccoon it should indicate, there seems to be no virtue in making such a change at present.

Later writers have tried to discover living examples of the original Alco with small success. Hamilton Smith (1840, p. 135, pl. 4, left-hand fig.) describes as *Canis alco*, what he supposed to represent this breed, from a stuffed specimen in an exhibition of Mexican curiosities made by W. Bullock, and said then to be in the Egyptian Hall (British Museum). He says of it: "That enterprising traveller described it as of the wild race; yet, from its appearance, we at first considered it to be a Newfoundland puppy." The figure shows a small black and white dog with rather full-haired tail, clumsy build, and ears laid back. Of the mounted specimen, Hamilton Smith further writes:—"It was small, with rather a large head; elongated occiput; full muzzle; pendulous ears; having long soft hair on the body. In colour, it was entirely white, excepting a large black spot covering each ear, and part of the forehead and cheek, with a fulvous mark above each eye, and another black spot on the rump; the tail was rather long, well fringed, and white." This description, except for the pendulous ears might apply well enough to the type of small dog here treated. How much of its appearance was due to the taxidermist's efforts is, however, to be considered. It is even possible that it was after all only a spaniel, which, except for its short ears, it seems to resemble.

What seems to have been a slightly deformed Indian Dog, is described and figured by Dugés (1882) as a Chihuahua Dog (a term that is used by fanciers for a dwarf breed, with erect ears). From his figure of the skull, it is evident that the animal was young. It was apparently rather small, had but three lower premolars (the first lacking), a rather heavy head, and long close-haired tail. The back seems to have been unduly arched but the head is represented as erect, and the posture quite different from that of a raccoon. The color was blotched black and white. The ears were cropped, but were assumed to have been erect. So far as can be judged from Dugés's account, this may have been a dog similar to the Techichi. He, however, supposed it to represent the Alco.

The confusion of names has been added to by Cope (1887) who examined three skulls of the so called Chihuahua Dog. He found a variable reduction in the number of teeth, correlated apparently with the loss of hair. The premolars were reduced to  $\frac{2}{3}$  or  $\frac{1}{3}$ , while the molars were  $\frac{1}{2}$ ,  $\frac{1}{3}$ , and  $\frac{1}{4}$  respectively. In all, the inner cusp of the lower sectorial was lacking. On account of the reduced number of

molars, and this character of the sectorial, Cope refers this breed to his genus *Dysodus* (Cope, 1879, 1879a) based on the Japanese Lap-dog, adding that "the species may be called *Dysodus gibbus*," for "the Chihuahua dog is the *Canis gibbus* of Hernandez." The animal to which Hernandez applied the adjective "*giberosus*," however, was with little doubt a Raccoon.

*Skeletal Remains.*— Among a great number of bones of Indian dogs examined, from mounds, burials, or refuse deposits in various parts of America, there occur skulls or fragments of jaws appertaining to a wholly different type of dog from the large varieties just described. The remains indicate a small light-limbed animal, with slender muzzle abruptly narrowed in front of the third premolar. Although the surface of the brain-case in adults is roughened for muscular attachment the sagittal crest does not develop till old age. All the teeth are small (upper carnassial 14–16.5 mm. in length), the nasals long, and the skull normal, in that it seems not shortened or broadened in any way, the teeth not crowded. A transverse line at the end of the palate falls about through the middle of the second molar. These dogs are probably the third variety of Hernandez, the Techichi or Small Indian Dog. Several skulls, more or less imperfect, from the Madisonville, Ohio, village site are referred to this breed, though their measurements are a very little larger than those of more southern specimens. They occur here together with bones of the large type of Indian Dog. An imperfect cranium (M. C. Z. 7,123) collected many years ago in McPherson's Cave, Virginia, by Lucien Carr, is apparently in every respect similar to a skull of this type from Pecos, N. M., obtained by Dr. A. V. Kidder in the course of excavating a village site. A similar but slightly smaller, though adult, skull from Pueblo excavations in the southwest is practically the same, as is also a skull of the Papago Indian Dog obtained by the late Dr. Edgar A. Mearns at Sonoyta, Sonora, while on the Mexican Boundary Survey. It is not fully adult, though of nearly mature dimensions. What seems to be a dog of this type is represented in the Peabody Museum by a cranium and hind leg-bones from Labna, Yucatan; the rostrum is damaged and the teeth lost except the carnassial. The long slender limb-bones are in strong contrast with the short thick bones of the Short-nosed Indian Dog.

Turning now to South America, the Museum has a cranium from Surinam, labeled:—Carib Indian Dog. It was received through the Boston Society of Natural History from the Wyman Collection, and was probably collected by Dr. F. W. Cragin, some fifty years ago

Though it has acquired the adult dentition, it is not old, and the temporal ridges have not yet united to form a crest. A very similar skull from French Guiana is figured by Blainville (1841) under the name *Canis familiaris cayennensis*, by which he seems to have intended to name the native dog.

I am indebted to Dr. W. C. Farrabee for a photograph, (Plate 5, fig. 2) which is assumed to illustrate this dog. It was secured by him while studying the Macusi tribe in southern British Guiana, and shows an old dog, and a puppy, accompanying a child of the tribe. The larger dog has a narrow head, and erect ears, the tips of which have been cropped, probably as a propitiation to evil spirits; the body is short in proportion to the lean limbs, the tail (better seen in the picture of the puppy) is long, upcurving, and like the body, short-haired. Dr. Farrabee writes that these dogs "are small, yellow and white, or brindle and white, and may be very much mixed with European dogs." Of their ancestry, however, there is no evidence, though the erect ears and slender proportions favor the supposition that they retain a measure of their aboriginal character. The expression of the larger dog recalls the "tristi aspectu" of Hernandez's description of the Techichi. It is not unlikely that the small dogs found by the Jesuits among the Indians of the southern Antilles and parts of Colombia and Central America may have been of the breed here described.

Dr. Farrabee writes me further concerning some larger dogs which he saw among the Wanoai tribe "who occupy the Akarai Mountains, northern Brazil to southern British Guiana. This tribe, on the Brazil side had never seen white men before [his visit]. They have the best dogs of all the tribes visited and they take the best care of them. These dogs are noted among the tribes a month's journey away. They keep the dogs tied on raised platforms and allow them exercise morning and evening. The dogs are all black and white and of good size." A small photograph of these dogs shows a hound-like aspect and drooping ears. They are probably of European origin and perhaps the same as the dogs mentioned by Bancroft (1769, p. 140) who says: "The Dogs of *Guiana* seem to be of a species between the Hound and Land-Spaniel: their make is slender, their ears long and pendulous, with a blunt nose, and large mouth: their bodies are covered with long shaggy hair, generally of a fallow colour. They pursue and start the Game by the scent."

I am indebted to J. Rodway, Esq., of the Museum at Georgetown, British Guiana, for a brief note on the hunting-dog of the present-day

Indians of that country. He considers that it is of undoubted European origin, "has no particular characters," and "could be matched in any lot of mongrels. It is generally rather small with a pointed muzzle, foxy looking, and kept hungry to prevent laziness." The "foxy" appearance is somewhat typical of the native breeds of smaller Indian dogs, a result of the fine muzzle, ample erect ears, and drooping tail, traits which seem still traceable among these mongrels of the modern Guiana Indians.

Among a series of dog-skulls (belonging to the U. S. N. M.) from ancient burials in Peru are two which in their small size and slender proportions seem referable to the Techichi. Both are fully adult, with a well-developed sagittal crest on the interparietal, extending forward in the larger skull on to the parietal suture. As will be seen from the table of measurements appended these skulls are a very little larger, with slightly shorter nasals, as compared with the other skulls whose dimensions are given. It is possible that this is due to some admixture with the short-nosed breeds. Nevertheless the skulls in question are quite different from the latter in their slender and narrow outlines, and unshortened tooth-row.

No doubt, did we know the external characters of the dogs whose skulls are here listed, it would be possible to recognize more than one breed. Thus the Ohio individuals are a trifle larger in dimensions, than those of the Southwest and the Peruvian dogs again are a little larger. Yet all are clearly of the same general type.

A comparison of the skulls and measurements of these specimens with those of the *Canis palustris* of Rüttimeyer from the Swiss Lake-Dwellings of late Neolithic to Bronze times in Europe, reveals a rather close correspondence which is probably more than accidental, and may even indicate a derivation from some common Asiatic stock at a very early period. The type of small dog of the Swiss Lake-Dwellings was one apparently of general distribution in southern Europe during the Neolithic time, and Woldrich (1886a) has identified it as far north as Denmark in the kitchen-middens. It was apparently, on the average, of wider zygomatic breadth, but otherwise its dimensions corresponded very closely. This evidence favors the view that a dog of this type was one of the earliest to be domesticated and was of wide distribution in an early period of human culture. Remains of a larger type of dog, *C. intermedius*, are also wide-spread in late Neolithic or Bronze culture layers of middle Europe, and correspond broadly to the larger type of Indian dog, a parallelism that is suggestive of the common origin of the large and the small types of dogs in Europe and America, probably from Asiatic prototypes.

Cranial Measurements	Ohio: Madisonville P. M. 67,700	Pueblo Indians P. M.	Va.: Lee Co. M. C. Z. 7,123	N. M.: Pecos M. C. Z. 9,520	Sonora: Sonoyta U. S. N. M. 63,169	Surinam M. C. Z. 10,844	Peru: Chicama U. S. N. M. 172,861	Peru: Coyungo U. S. N. M. 176,387	Yucatan: Labna P. M.
Alveolus of $i^1$ to occipital condyle	—	132	140	138	142	137	139	145	—
“ “ “ “ median edge of palate	—	71	74	74.5	76	73	74	78	—
Alveolus of $i^1$ to orbit	67	61	63	64	64	62	61	62	—
“ “ “ “ alveolus of molar <sup>2</sup>	80	74	77	77.5	77	76	76	80	—
“ “ $c$ “ “ “ $m^2$	67	61	63	65	64.5	64	63	65	—
“ “ $p^1$ “ “ “ $m^2$	54	49	51	52	51	50	51.5	49	—
“ “ $p^2$ “ “ “ $m^2$	47	42.5	46	47	46	45	45	43	—
“ “ $m^1$ “ “ “ $m^2$	17	—	14	16	15	14	16	16	—
Length of upper carnassial, $p^4$	16.6	14.5	14.3	15.5	15	14	16.3	16	16
Median length of nasals	—	—	—	48	49	47	45	45	44
Width across occipital condyles	—	—	29	31	29	33	31	32	—
“ “ palate at $m^1$	52.5	53	51	51	47	47	55	56	—
“ “ supraorbital processes	43	41	—	39	—	40	42	46	—
“ “ zygomata	—	84	83	84	82	77	90	—	78
Lower jaw, alveoli $i^1$ to $m_3$	—	—	—	79	79	—	—	—	—
“ “ “ $c$ to $m_3$	—	76	—	74	74.5	—	—	—	—
“ “ “ $p_2$ to $m_3$	—	59	—	58	57	—	—	—	—
“ “ “ $p_3$ to $m_3$	—	—	—	49	48.5	—	—	—	—
“ “ “ $p_4$ to $m_3$	—	—	—	40	39	—	—	—	—
“ “ “ $m_1$ to $m_3$	—	—	—	32	30	—	—	—	—
Length of $m_1$	—	18.5	—	18	17.5	—	—	—	—
Skeletal Measurements									
Femur	—	—	—	—	—	—	—	—	128
Tibia	—	—	—	—	—	—	—	—	130

*Early Accounts.*—Hernandez disposes of the Techichi in few words, as being the third sort of dog he knew to be found in Mexico. It must have become scarce by his time (about 1578) as he had not seen it himself but describes it thus:—“*Catulis similis est nostratibus, Indis edulis, tristi aspectu, ac caetera vulgaribus similis*” (similar to our spaniels, eaten by the Indians, of melancholy visage, but otherwise like the common dogs). J. Jonstonus, writing in 1657, includes in his account of dogs, a transcription of Hernandez’s passage as to

the three sorts of dogs in Mexico. He adds further that the Indians of Cozumel Island ate these dogs as the Spaniards do rabbits. Those intended for this purpose were castrated in order to fatten them.

Clavigero, the historian of early Mexico, wrote that the breed was extinct in his time, due, as he supposes, to the Spaniards' having provided their markets with them in lieu of sheep and cattle.

Possibly this breed of dog is the one mentioned in De Soto's relation of his march through Florida. At one place the cacique of the village sent him a present including "many conies and partridges. . . many dogs. . . which were as much esteemed as though they had been fat sheep." At another place, "the Christians being seen to go after dogs, for their flesh, which the Indians do not eat, they gave them three hundred of these animals." Again, at a small Indian village called Etocali, the expedition got "maize, beans, and little dogs, which were no small relief to the people."

As late as 1805, Barton (1805, p. 12) who had made special inquiry of William Bartram, as to the dogs of the Florida Indians, quotes him, that the latter had in addition to the larger dogs, a smaller breed, about the size of a fox, which probably was of the type under discussion.

It is probably this dog, if not also the short-nosed variety, that figures largely in the mythology of the Mayas of Yucatan. Among several representations of the dog in the Mayan codices are seen short-nosed and long-nosed heads, but whether these really indicate different breeds of dogs or different artists that made them cannot be determined. All are shown with erect, sometimes with cropped ears, a tail that is of medium length, usually shaggy, and recurved. Black patches are commonly represented on the body, and the eye of the dog often centers in a black area. Seler (1890) speaks of its use as a sacrificial animal in Yucatan, sometimes in place of a human being. Placed in the grave, the dog carried its master's soul across the "Chicunauhapan" or nine-fold flowing stream. According to Sahagun, some were black and white, others dark red, and there were short-haired and long-haired dogs, but he does not state whether the small and the large types of dogs each had short-haired and long-haired varieties. A brief summary of the significance of the dog in the religious life of the Mayas is given by Tozzer and Allen (1910, p. 359).

## HARE-INDIAN DOG.

## Plate 1, fig. 2.

1829. *Canis lagopus* Richardson, Fauna Boreali-Amer., 1, p. 78, pl. 5 (not *Canis lagopus* Linné, 1758, *q. e. Alopex*).

1867. *Canis domesticus, lagopus* Fitzinger, Sitzb. K. akad. wiss. Wien, 56, pt. 1, p. 407.

— *Canis familiaris orthotus lagopus* Reichenbach, Regn. anim., pt. 1, p. 13.

*Characters.*— A small, slender dog, with erect ears and bushy tail, feet broad and well-haired. Color white with dark patches.

*Distribution.*— Formerly found among the Hare Indians and other tribes that frequented the borders of Great Bear Lake and the banks of the Mackenzie River.

*Description.*— This seems to have been a small dog, of the Techichi type. Richardson, who gave a figure and description of it from first-hand acquaintance, characterizes it as slightly larger than a fox but smaller than a coyote, and apparently of rather slender proportions. The head was small with sharp muzzle, erect thickish ears, somewhat oblique eyes; the tail bushy and sometimes carried curled forward over the right hip, though this does not appear in Richardson's figure; foot broad and well-haired. He describes an individual as having the face, muzzle, belly, and legs white; a dark patch over the eye, and on the back and sides, larger patches of dark blackish gray or lead color, mixed with fawn and white. Ears white in front, the backs yellowish gray or fawn; tail white beneath and at the tip.

*Notes.*— It seems probable that this small breed was lost in the early part of the last century. At all events, writers subsequent to Richardson do not seem to have met with it, and those that mention it, seem to have confused it with the Common Indian Dog. Thus B. R. Ross (1861) and Macfarlane (1905, p. 700) clearly had in mind a different animal; and a skull sent by the latter to the U. S. N. M. as *lagopus* (from Fort Simpson, Mackenzie River) is a large dog, evidently the Common or Larger Indian Dog. Hamilton Smith (1840, p. 131) takes his description in part from Richardson, and mentions a pair of these dogs as then living in the Zoölogical Society's Gardens at London. Audubon and Bachman likewise are indebted to Richardson for their account, though their figure, by J. W. Audubon, is said to be from a stuffed specimen, perhaps one of those previ-

ously living in the Zoölogical Society's Gardens. The dimensions they give however, seem rather large.

Richardson says further that it was used solely in the chase and was probably too small to serve as a burden carrier. Its voice was a wolf-like howl, but at some unusual sight it would make a singular attempt at barking, commencing with a peculiar growl and ending in a prolonged howl.

Here may be mentioned what seems to be an unknown or vanished breed of dogs as indicated in the account of Frobisher's voyage to Arctic America in 1577. At the present Frobisher Bay, in south-eastern Baffin Land, the expedition found in addition to the large dogs used for sledging, a smaller breed, which was apparently used only as food, and allowed the freedom of the skin tents of the Eskimos. The historian of the expedition writes that they "found since by experience, that the lesser sort of dogges they feede fatte, and keepe them as domesticall cattell in their tents for their eating, and the greater sort serve for the use of drawing their sleds." At York Sound, the same writer relates that on going ashore to examine "certaine tents of the countrey people," they "found the people departed, as it should seeme, for feare of their comming. But amongst sundry strange things which in these tents they found, there was rawe and new killed flesh of unknowen sorts, with dead carcasses and bones of dogs" (Hakluyt's Voyages, Everyman's Library, ed. 5, p. 212, 215). Concerning this "lesser sort of dogges," nothing further seems to be known, whether they were a dwarf variety of the Eskimo dog, or as seems likely, a small breed similar to those of the Hare Indians or of other tribes of the mainland.

#### FUEGIAN DOG.

##### Plate 4, fig. 2.

*Characters.*—Size small, as large as a terrier, muzzle slender, ears large, delicate, and erect, body and limbs well-proportioned, shoulders higher than rump; tail long, drooping, slightly recurved at the tip and well-fringed; feet webbed; color uniform grayish tan, or often with patches of black or tan, and areas of white; inside of the mouth dark-pigmented.

*Distribution.*—Found chiefly among the "Canoe Indians" — Yah-gans and Alacalufs — of the Fuegian Archipelago, from Cape Horn to Beagle Channel, and northwestward, probably at least to the western part of Magellan Strait.



*Descriptions.*—The best account of the Fuegian Dog is that given by d'Herculais (1884) of two Yahgan Dogs brought back to France by Dr. Hyades of the Mission scientifique au Cap Horn (expédition de la ROMANCHE), in 1883. These were obtained as puppies from the Yahgans at Orange Bay and grew up to be tame and affectionate dogs. They are described as small but well-proportioned, remarkable for their large pointed and erect ears, and very sharp slender muzzles. The color-pattern is very variable, often a uniform grayish tan recalling the jackal; again, the body is marbled with extensive black or tan areas on a white ground. The feet are plainly webbed. The two dogs above referred to, were said to measure, the male and female respectively:—height at shoulder, 49 and 44 cm.; length from tip of nose to root of tail, 80 and 72 cm.; length of tail, 26 and 23 cm.

*External Measurements.*—Dechambre (1891) in a note on these same dogs, gives the following dimensions, evidently of a female:—

Scapuloischial length.....	52	cm.
Height at shoulder.....	41	"
Height at rump.....	39	"
Height at axilla.....	25	"
Thoracic perimeter.....	58	"
Distance between ears.....	9	"
"    "    inner corners of eyes.....	4.5	"
"    "    outer    "    "    ".....	8.5	"
Breadth of forehead.....	11	"
Length of head.....	22	"
"    "    muzzle.....	9	"
Interorbital width at outer corner of eye.....	9.5	"

The further description by Dechambre supplements that of d'Herculais based on the same individual. He describes its fox-like head with pointed muzzle, broad forehead, its erect and high-set ears, usually directed forward, very mobile; eyes slightly oblique. The body is large, limbs slender, the neck short and powerful, the shoulders slightly higher than the rump; tail bushy and carried high. Pelage with a short under fur, pied black and white, passing to slaty at the throat, clouded with tan; over each eyebrow a white spot with a few fulvous hairs. The coat has the appearance of a domesticated animal in its pattern.

Captain Fitzroy of the BEAGLE, in a letter to Hamilton Smith (1840, p. 214) describes these dogs of the 'Canoe Indians' as resembling "terriers, or rather a mixture of fox, shepherd's dog, and terrier. All

that I examined had black roofs to their mouths, but there was much variety in the colours and degrees of coarseness of their coats. \* \* \* Many Fuegian dogs are spotted and not a few have fine short hair, but all resemble a fox about the head. \* \* \* One brought from Tierra del Fuego was white with one black spot, and very handsome; his size was about that of a terrier, his coat short but fine, and his ears extremely delicate and long, although erect;" the muzzle also is long, the tail rough and drooping.

*Skull and Limb-bones.*—In a recent paper, Professor Lönnberg (1919) has given what appear to be the first published figures and measurements of the limb-bones and skull of this dog. His specimen was a skeleton obtained by Nordenskjöld in 1895-96 during his Tierra del Fuego expedition. As this author demonstrates, the skull is that of a true dog, and shows no relationship with the native canid, *Pseudalopex lycoides*. A comparison of the cranial measurements with those given for the Techichi of North and South America, shows a very close approximation, amounting almost to identity. The first lower molar in the Fuegian Dog seems smaller, however, 16.5 mm. in Lönnberg's specimen against 17.5 to 18.5 mm. in the more northern dogs. For better comparison, the following measurements of the Fuegian Dog are reproduced from this paper (Lönnberg, 1919, p. 11):—

Condylar-incisive length.....	141	mm.
Length of palate.....	71.3	"
Front of canine to back of $m^3$ .....	64	"
Length of premolar <sup>4</sup> .....	15.2	"
Length of upper premolar-molar series....	51	"
Width of palate outside $m^1$ .....	52.6	"
Zygomatic width.....	81	"
Length of nasals mesially.....	46	"
Length of lower $m_1$ .....	16.5	"
Length of humerus.....	105	"
Length of ulna.....	125	"
Length of femur.....	132	"
Length of tibia.....	139	"

*Uses.*—The Fuegian Dog is active and strong in proportion to its small size; quiet, faithful to its master, and able to withstand much privation; vigilant and extremely sly. It is capable of barking like the European dogs.

They are of invaluable service to their masters in hunting, particularly in the pursuit of otters (*Lutra felina*), which are assiduously

sought. Indeed Fitzroy wrote that "it is well ascertained that the oldest women of the tribe are sacrificed to the cannibal appetites of their countrymen rather than destroy a single dog. 'Dogs,' say they 'catch otters; old women are good for nothing.'" They are vigilant watch-dogs, barking furiously at a stranger. Their small size, and consequent adaptability as canoe companions, are no doubt the chief cause for their preference by the Canoe Indians of the west Patagonian Archipelago, over the larger dogs found among the so-called Foot Indians of the mainland and the eastern and inland parts of Tierra del Fuego.

*Remarks.*—In the absence of specimens for comparison, it is not altogether clear that the Fuegian Dog can be satisfactorily distinguished except in minor particulars from the Techichi or Alco of Peru and Mexico. Molina apparently thought it identical. In general it appears closely similar, but perhaps of more slender build, a bushier tail with recurved tip, well-palmated feet and a shaggier coat, though Fitzroy speaks of variation in this last character.

In his Bibliography of the Fuegian tribes, Cooper (1917, p. 186) has summarized the references to dogs in the literature referring to these people. As early as 1557, or perhaps 1553, the Chonos at the northern end of the Chilian Archipelago, were credited with having dogs, as appears from Goicueta on the authority of Cortés Hojea. The first mention of dogs in the Strait of Magellan appears to be that of Narbrough, who in 1670, found the natives of the Elizabeth Islands in possession of large mongrel dogs of several colors. He compared them to the race of Spanish dogs he had found among the Patagonians of Port Julian. Probably these were not of native stock. Twenty-six years later de Gennes saw five or six small dogs among the Alacalufs of Port Famine. The Mánekenkn met by the first Cook expedition in 1769 at Good Success Bay, southeast end of Tierra del Fuego, had dogs about two feet high with sharp ears; they all barked. The small dog here described is apparently found among the so-called Canoe Indians of the western archipelago, the Yahgans and Alacalufs, the most southerly tribes of men in the world.

#### SHORT-NOSED INDIAN DOG.

Plates 6, 11.

1885. *Pachycyon robustus* J. A. Allen, Mem. M. C. Z., 10, 13 pp., 3 pls.  
 1885. *Canis ingae vertagus* Nehring, Sitzb. Gesellsch. naturf. freunde Berlin, p. 5-13 (not *Canis familiaris vertagus* Linné, Syst. nat., 12th ed., 1766, 1, p. 57.

*Characters.*—A stoutly built dog, the size of a small terrier, with erect ears, short heavy muzzle, high forehead, short body and limbs, well-developed tail.

The color seems to have been black and white; sometimes more uniformly black, or yellowish with dark blotches.

The skeleton is stoutly proportioned, the limb-bones short and thick, the humerus with a very small or no olecranal perforation. The sagittal crest is chiefly developed at the occiput. Correlated with the slight reduction of the maxillary bones, and the widening of the palate, is the fact that the last molar is placed just in advance of a transverse line through the posterior boundary of the palate.

*Distribution.*—Skeletal remains of this peculiar small dog have been found in Virginia in a superficial cave-deposit, as well as in the shell-mounds of San Nicolas Island on the coast of southern California. A well-preserved dried or mummified example was lately discovered by Mr. S. J. Guernsey in a burial antedating the Cliff Dwellers, in the Marsh Pass region of Arizona; and Reiss and Stübel have discovered its mummified remains in the prehistoric necropolis of Ancon, Peru (see Nehring, 1884b). In the M. C. Z. is a humerus lacking the epiphyses, of a young specimen from Pecos, New Mexico, obtained by Dr. A. V. Kidder. These localities may be taken as limiting the known extent of its distribution.

*Notes.*—In 1885, Dr. J. A. Allen described as a new genus and species *Pachycyon robustus*, an extinct type of dog from Ely Cave, Lee County, Virginia, basing his account upon a pelvis, a femur, a tibia, a scapula, and a humerus of which he publishes excellent illustrations. These bones were obtained in the course of excavating the superficial layer of earth on the cave-floor, and though it is not certain exactly at what point they were found, no excavations deeper than a foot were made. Remains of Indian occupation were numerous, and other bones were obtained in the cave. There is nothing to indicate great age in the type-specimens (M. C. Z. 7,091); indeed the bones are quite fresh in appearance, only slightly discolored with earth. They are chiefly notable for their small size and rather heavy ungraceful proportions, while the humerus is particularly marked on account of its lacking the usual perforation over the middle of the epicondyle. This perforation is almost always present in Eurasian dogs, as well as in coyotes and wolves. No further light has since been shed on the nature of this animal nor have any parts of its skull been found.

Among the remarkable discoveries made by Mr. S. J. Guernsey in the course of archaeological exploration in the Marsh Pass region of

Arizona for the Peabody Museum, were the dessicated remains of two dogs with human burials of an age apparently antedating the culture of the Cliff Dwellers. One of these dogs is small, about the size of a Fox-terrier but more compactly and heavily built, with a shorter head, erect ears, and longer tail. It still shows a black and white pattern, with a narrow median white line from nose to forehead, a white chin, throat, and belly, a white collar, white feet, and tail tip. Much of the body is black. In the length of the limb-bones and pelvis as nearly as can be determined from careful study of the dried and mummified specimen, it corresponds exactly with *Pachycyon*. By making incisions through the dried tissue at the elbow, it was possible to lay bare the olecranal cavity above the joint where the large perforation is usually present. It was found that in the right humerus a small perforation was present, about 3 mm. in diameter, while in the left humerus there were merely two small pores side by side. The animal was young, still retaining a milk incisor, and so it is likely that had it been as old an individual as the one whence the type-bones of *Pachycyon* were derived, these foramina would have ossified completely, perhaps leaving, as in the type-humerus, a shallow pit in the posterior side of the olecranal fossa, as an indication of the former perforation. So complete is the correspondence of the bones of *Pachycyon* with those of this prehistoric dog of Arizona that they may be unhesitatingly pronounced those of a similar if not identical breed of Indian dog.

Not less interesting is a comparison of the humerus of *Pachycyon* with a humerus figured by Nehring (1884b, Plate 118, fig. 4, 4a) from a mummified dog exhumed with human-mummies in the ancient necropolis of Ancon, Peru. In measurements, there is practical identity as shown in the following table (the measurements of the Ancon humerus are taken directly from Nehring's figure, of natural size): —

	<i>Pachycyon</i>	Ancon
Greatest length of humerus.....	97 mm.	97 mm.
Greatest diameter through head of humerus.....	31.5	29.5
Transverse " " " " ".....	21	24
Transverse diameter of distal end of same.....	25	25

Nehring's figure shows substantially the same type of thick stout humerus, and as he remarks, has the further peculiarity of lacking any trace of perforation of the olecranon fossa. It should be added that the humerus, shown in his figure is nevertheless very slightly

more bowed than that of the type of *Pachycyon*, and in his opinion the Peruvian Dog corresponded closely to a European Turnspit or Dachshund, whence he calls it *Canis ingae vertagus*. The figures of the skull of the same specimen likewise show an apparent similarity in outline and proportions to that of the Arizona mummy.

There seems thus to be no doubt that *Pachycyon robustus* is after all only a breed of dog cultivated by the Indians of the southern parts of North America and of Peru. It is therefore no longer to be thought of as a problematical mammal of the Pleistocene.

Among the dog-bones obtained by the University of California's investigations of the Indian shell-mounds on San Nicolas Island, off the coast of southern California, are two crania nearly identical in measurements with the Marsh Pass specimen that appear to represent this same small, short-nosed dog. They are characterized by their broad brain-cases, spreading zygomata, wide palates, shortened rostra, and small teeth. In profile the dorsal outline of the brain-case is gently rounded, not flat. The shortness of the rostrum does not amount to real deformity however, for the lower jaw closes normally into its place and the premolars are not markedly crowded, though  $p^2$  is turned at an angle of nearly  $50^\circ$  from the axis of the skull to adapt its position to the sudden narrowing of the skull at this point. Premolars 1 and 2 are normal in position, and there is a short diastema between  $p^1$  and the canine. The ossification seems particularly heavy, yet though old, neither skull has developed a sagittal crest except at the interparietal region. In the dried mummy from Marsh Pass, the shortened nose and elevated forehead give a characteristic appearance to the head which is evident in these crania as well. No limb-bones that can be assigned to this dog, have appeared among the Californian collections. In both crania the opening of the posterior nares is narrow, and a transverse line drawn at right angles to the cranial axis at the posterior end of the palate falls behind the last molar, indicating deviation from the normal condition.

The following skull-measurements show close agreement. One of the Californian crania (1884b) lacks any trace of the alveoli of  $m^2$  which are partly broken and partly resorbed. The first premolar is wanting also. The proportions of the maxilla are, however, practically the same in both specimens. The Ancon specimen is figured by Nehring (1884b) of natural size and the measurements are taken from this figure. It too lacks the first upper premolar, and in every respect conforms to the appearance of the other crania.

Measurements of the Skull	Peru: Ancon	Ariz.: Marsh Pass	1 16,355 Calif.	1 16,356 Calif.
Greatest length, occiput to median incisor (alveolus) .....	141	?132	138	138
Greatest length, edge of foramen magnum to median incisor .....	—	—	123	121
Median incisor to edge of palate .....	—	—	68	68
“ “ “ orbit (anterior edge) .....	55	—	54	54
“ “ “ $m^2$ (alveolus) .....	72	71.5	69	—
Canine “ $m^2$ “ .....	59	60	59	—
Premolars $1-3$ (alveoli) .....	—	22	20	—
Length of premolar $^4$ .....	16	16	—	17
Molars $1-2$ (alveoli) .....	16.5	—	16	—
Width of palate outside $m^1$ .....	—	—	56	56.5
“ “ “ $p^1$ .....	—	39	42	39
Zygomatic width .....	—	—	87	85
Mastoid width .....	—	—	54	53
Width of occipital condyles .....	—	—	30	31
Nasals, length .....	—	—	—	41

In addition to the limb-measurements given on p. 497, the Arizona mummy gives the following:—total length from tip of nose to tip of tail following curve of back, 705 (*circa*); tail about 195; ulna 120 (*circa*); carpus to end of longest claw 90; ear about 60–70 mm. long including hair; tail 195; femur 106 (*circa*); tibia 116 (*circa*); hind foot 122.

*Remarks.*—Although this type of dog seems to have been widespread among the aborigines of southern North America and north-eastern South America, it appears to have quite disappeared and is not clearly identifiable in any of the accounts of the early writers. Mr. Guernsey's discovery of a well-preserved mummy in a burial of considerable age in Arizona, has confirmed my previous identification of the Virginia bones of *Pachycyon* with those of Nehring's short-limbed dog-mummy of Ancon. The cranium is characterized by its breadth and stoutness, its shortened snout and high forehead, gently convex dorsal profile of the brain-case, and the small teeth (upper carnassial 16–17 mm.). The Californian crania agree substantially in every detail. Probably this is the same dog that Moore (1907, p. 423) discovered in Indian mounds on Crystal River, west Florida, of which Lucas observed, “the front of cranium of carnivore and jaws,

are from the same animal, the short-faced dog something like a bull-terrier that seems to have been a favorite with the Indians of the southwest".

#### PERUVIAN PUG-NOSED DOG.

##### Plate 12.

1885. *Canis ingae molossoides* Nehring, Sitzb. Gesellsch. naturf. freunde Berlin, p. 5-13.

*Characters.*— Similar to the Short-nosed Indian Dog but with even shorter facial bones, an undershot lower jaw, broader zygomata and posterior narial passage. The increased shortening of the face causes a slightly more elevated forehead. The color seems to have been yellowish or whitish, marked or clouded with dark brown.

*Distribution.*— This Dog is known only from the Peruvian Highlands, where its remains have been found with ancient burials of the aborigines at Ancon and Pachacamac.

*Skull-Characters.*— A comparison of six skulls from Peru (loaned by the U. S. N. M.) with those of the Short-nosed Dog of North America, leaves little doubt that the Peruvian Pug-nosed Dog is derived from the latter, perhaps through some sort of cross-breeding, possibly as an occasional result of a particular cross, or through the dominance of its peculiarities in cross-bred animals. In most respects, the skulls of both are essentially alike, but the shortening of the rostral portion in the present breed is more pronounced, resulting in an undershot lower jaw. Yet the reduction of the maxillaries is not so extreme as to cause very great crowding of the premolars as in our Bull-dogs or the Pekinese Lap-dogs. Thus in two out of six crania, the third premolar is set almost transversely to the long axis of the skull, but in the others it retains about the usual relation. The second premolar, in two cases, is turned inward at more than the usual angle. In only one of the six skulls is the first upper premolar missing, and here on the left side only.

The opening of the posterior nares is very wide in comparison with the common Short-nosed Dog, and the zygomatic arches are broader. In none of the six skulls do the temporal ridges unite to form a median crest except at the occiput along the interparietal bone. On account of the shortening of the facial bones, the forehead is high, with a deep and broad groove medially. A further result of this shortening is the greater upward turn of the palate, best seen when the crania are



on a flat surface. The palate of the Pug-nosed Dog, makes an angle with the table of about  $27^{\circ}$  against about  $15^{\circ}$  in the case of the longer-nosed breed. The same rugose surface of the brain-case, the *heaviness of bone* and the *thickened prominences* at each side of the posterior narial openings, characteristic of the Inca Dog, are seen in this breed as well.

No limb-bones have been obtained that can be referred to this dog, but it is likely that they were short and thick like those of the related breed.

The following table gives dimensions of the six skulls in the U. S. N. M. and is interesting for comparison with those of the Short-nosed Indian Dog.

Measurements of the Skulls	U. S. N. M.					
	172,685	172,883	172,886	172,887	172,884	176,307
Occipitorostral length (excluding incisors).....	124	—	138	138	142	145
Basal length.....	104	—	121	125	119	125
Palatal length.....	60	—	65	67	67.5	66
Orbit to tip of premaxillary.....	47	—	49	52	53	53
Upper tooth-row.....	64	—	—	—	—	—
"    "    (alveoli).....	60	—	68	61	69	69
Front of canine to back of molar <sup>2</sup> (crowns).....	—	—	—	—	58	—
Front of canine to back of molar <sup>2</sup> (alveoli).....	49	53	57	58	57	56.5
Length of premolar <sup>4</sup> (crown)....	16	16	15.5	16.5	17.5	16.5
"    "    "    (alveolus) ..	15	15	14.5	15	16	15
"    "    molars <sup>1-2</sup> (crowns)....	16.5	16.5	15.5	17.5	—	17
"    "    "    (alveoli).....	16.5	15.5	14	15.5	17	16.5
Lower tooth-row (alveoli).....	—	—	—	—	—	81
Zygomatic width.....	91	102	109	94	97	102
Breadth of occipital condyles....	27	27	30	29	28	31.5

*Remarks.*—The existence of this breed of aboriginal dogs with shortened face and undershot, bull-dog-like jaw, was first discovered by Reiss and Stübel in the course of their investigation of the necropolis of Ancon, Peru. Nehring (1885) published an account of their discovery and gave the Latin name *Canis ingae molossoides* to the

breed. At first but a single specimen was found among numerous other dog remains, but further search brought a few more to light, and more recently, the Yale-National Geographic Society Expedition has recovered several skulls, from Huacho and Pachacamac.

The presence of this pug-nosed dog among the ancient Peruvians is doubly interesting, not only in that this variation should have occurred here, apparently quite independent of similar cases in the Old World, but in that it should have been preserved, whether through accident, or as supposed, through purposeful selection. Such a shortening of the face through the imperfect development of the bones of the rostrum is found occasionally in other domesticated mammals. The short-faced Cheshire Hogs and similar breeds furnish like instances of the selection and preservation of this mutation, which appears to be definitely heritable. Among undomesticated species, the case of a European Fox is recorded by Dönitz (1869) in which the rostrum was shortened abnormally, producing a bull-dog-like appearance, with undershot jaw. The second and third premolars of the upper jaw were opposite the third and fourth respectively of the lower jaw, while the upper canine fitted into a space between the first and second lower premolars. Schmitt (1903) agrees with Studer (1901) that such cases are due to the retention of embryonic conditions but considers them to be a result of domestication. This, however, is not necessarily the case, as the above instance shows. The case of a "bull-dog-headed calf" is recorded by Warren (1910) as having appeared as a "sport" variation.

Notwithstanding the comparatively high cultural development of the Incas, it may be doubted whether they purposely bred these dogs for their peculiarity of face. Quite as likely the anomaly arose, perhaps as a frequent result of cross-breeding between certain of the other canine races, or as a local abnormality, which as a Mendelian character, frequently cropped out in chance crosses. This may be indicated by the apparent rarity of this type of dog in the Ancon burials, and by the considerable variation in slight details of the form of the skull, as if no special type were bred for.

An interesting anomaly of an opposite nature is worth recording in this connection, namely that of a Jackal shot by Dr. J. C. Phillips in Arabia (M. C. Z. 15,872) in which the *under* jaw has failed to reach its normal length and is overshot by the upper jaw. The lower canine closes *behind* the upper instead of anterior to it as in normal cases.

## SUMMARY.

Recent careful studies of the teeth indicate that the domestic dog's relationship is with the wolves rather than with the groups of canids represented by coyote, jackal, or fox. The ultimate wolf-like ancestor of the dog is yet to be determined, but present evidence favors the view that it was not one of the large circumboreal wolves, but possibly a distinct and smaller species, from which both large and small breeds of dogs have been derived.

The domestic dogs of the American aborigines were quite as truly typical dogs as those of Asia, and may be assumed to have reached America from that continent, with their human companions. Although it is possible that the larger dogs may interbreed occasionally with wolf or coyote, there is no good reason to suppose that such crossing has had much if any, influence on the original stock.

In a very general way, three types of dogs may be distinguished among the American aborigines: (1) the large, broad-muzzled, Eskimo Dog, with heavy coat and tail curled forward over the hip; (2) a larger and (3) a smaller Indian Dog, from which are probably to be derived several distinct local breeds. Of the larger style of dog as many as eleven varieties may perhaps be distinguished; of the smaller, five.

An interesting and suggestive parallel is found among prehistoric European dogs, of which in late Neolithic and early Bronze periods there were a large and a small type — *Canis intermedius* and *C. palustris* — corresponding rather closely to the Larger or Common Indian Dog and the Small Indian Dog or Techichi. The obvious probability is that these two general types of dogs were then widely cultivated in Asia, and at a very early period reached Europe and America with the human immigrants. In a similar way the Eskimo Dog is of a type common to northern Asia and Europe, and doubtless reached America with the Eskimos, whose arrival, at least in eastern America is usually regarded as relatively recent.

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**EXPLANATION OF PLATES.**



**PLATE 1.**

PLATE 1.

Fig. 1.—Eskimo Dog. The grandparents of this dog were brought by Peary from Smith's Sound, Greenland. Photo by Ernest Harold Baynes.

Fig. 2.—The Hare-Indian Dog of northern Mackenzie. From Richardson's plate (1829).



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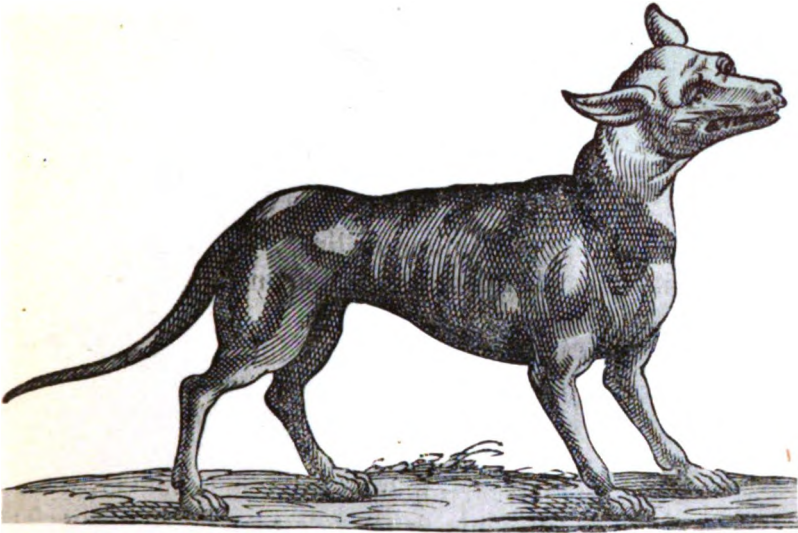


**PLATE 2.**

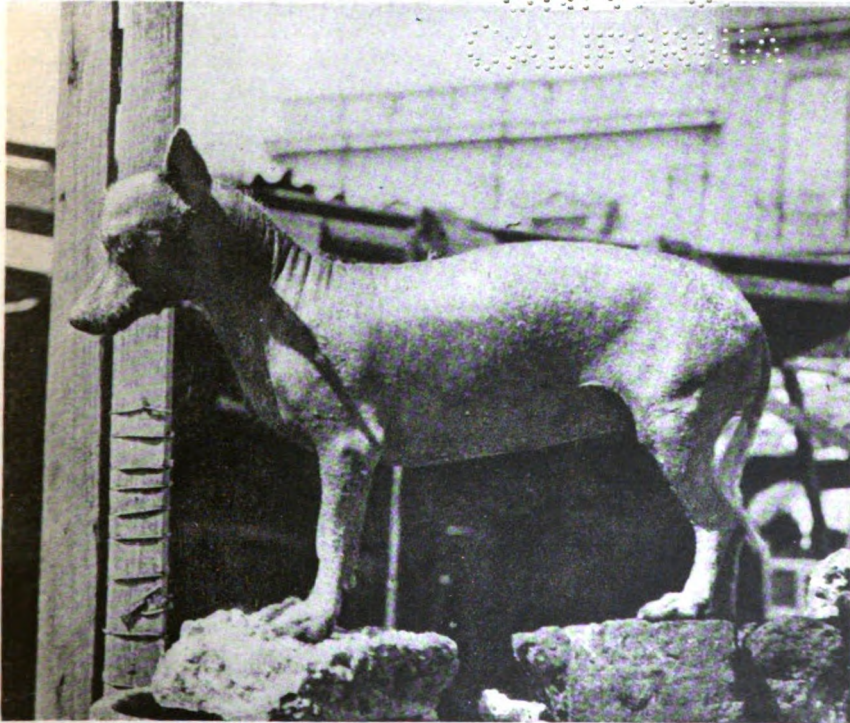
PLATE 2.

Fig. 1.— Mexican Hairless Dog. Reproduction of figure of *Lupus mexicanus* from Recchi and Lynceus (1651).

Fig. 2.— Mexican Hairless Dog, ♀. Photograph by Arthur Stockdale of Mexico City. Courtesy of The Journal of Heredity.



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**PLATE 3.**

PLATE 3.

- Fig. 1.— The Ytzcuinteporzotli or *Canis mexicana* of Hernandez, reproduced from the figure by Recchi and Lynceus (1651) . It probably represents a Raccoon.
- Fig 2.— On the right a Mexican Hairless Dog, on the left a hairy dog from the same litter. The parents of these two were a Mexican Hairless Dog shown in Plate 2, fig. 2, and a mongrel dog, normally haired. Courtesy of the Journal of Heredity.



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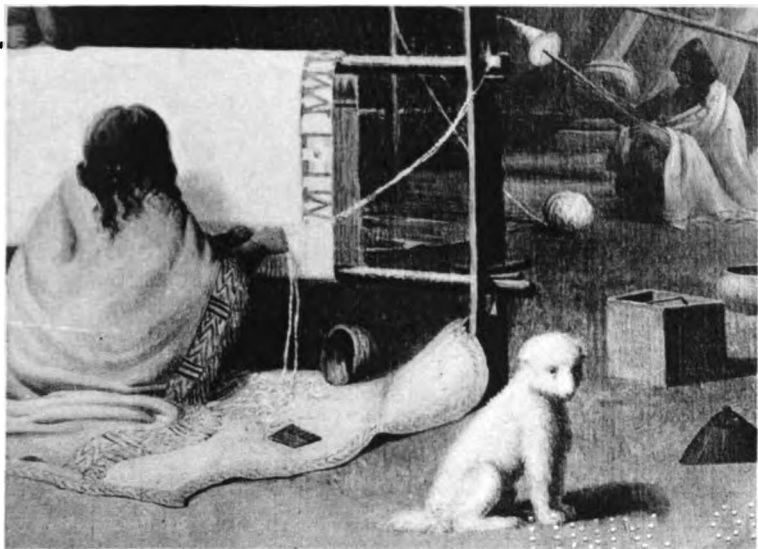


**PLATE 4.**

PLATE 4.

Fig. 1.—Clallam-Indian Dog. From the painting by Paul Kane in 1846, now in the Royal Ontario Museum of Archaeology at Toronto.

Fig. 2.—Fuegian Dog. Reproduction of d'Herculais' (1884) figure drawn from a dog brought to France from Tierra del Fuego by the Mission Scientifique du Cap Horn.



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**PLATE 5.**

PLATE 5.

Fig. 1.— A dog of the Bersimis Indians, Canada, supposed to represent the Short-legged Indian Dog. Photograph by William B. Cabot.

Fig. 2.— Small yellow-and-white or brindle dogs, with a child of the Macusi Indians in southern British Guiana. These dogs may have more or less blood of European stock, but probably retain some aboriginal characteristics. Photograph by Dr. William C. Farrabee.



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**PLATE 6.**

PLATE 6.

The Short-nosed Indian Dog ("Pachycyon"). A mummified specimen collected by Messrs. S. J. Guernsey and A. V. Kidder in the Marsh Pass region, Arizona, and now in the Peabody Museum of Archaeology. Photograph by S. J. Guernsey.



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**PLATE 7.**

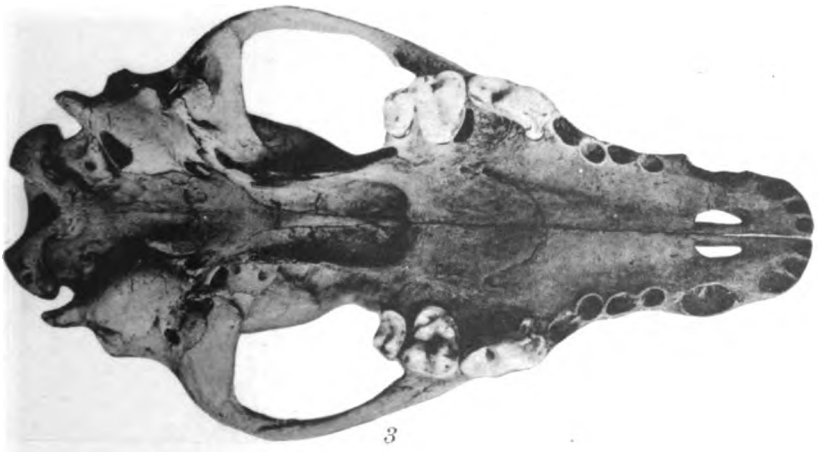
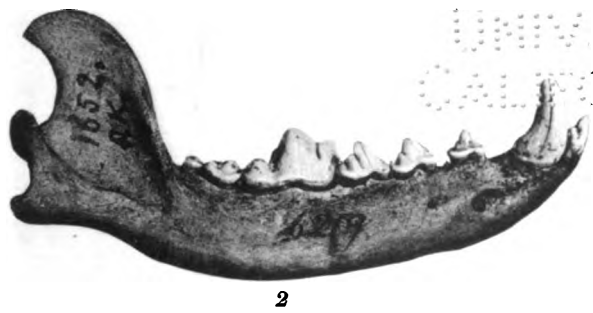
PLATE 7.

Skull of the Common Indian Dog, collected by Kennicott on Peel River, northern Mackenzie, U. S. N. M. 6,219. Length 177 mm.

Fig. 1.— Cranium in profile showing relatively weak crests and slender muzzle.

Fig. 2.— Lower ramus; the first premolar normally lacking.

Fig. 3.— Cranium, ventral view; upper first premolar lacking.



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ALPHABET



**PLATE 8.**

PLATE 8.

Cranium of the Common Indian Dog from Le Moine shell-heap, Frenchman's Bay, Maine, collection of Phillips Academy, Andover, Mass., 53,902 Me. Length 192 mm.

Fig. 1.— Profile view.

Fig. 2.— Ventral view. The first upper premolar is lacking.



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**PLATE 9.**

ALLEN. — Dogs of the American Aborigines.

PLATE 9.

Cranium of an Inca Dog, collected by Dr. A. Hrdlička at Huacho, Peru, U. S. N. M. 176,309. Length, occiput to anterior root of incisors, 178 mm.

Fig. 1.— Profile.

Fig. 2.— Ventral view. The first premolar is present on the left side only.



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**PLATE 10.**

PLATE 10.

Small Indian Dog or Techichi, from a cranium collected by L. F. Carr, in Ely Cave, Lee County, Virginia, M. C. Z. 7,123. Length, occiput to tip of premaxillaries, 140 mm.

Fig. 1.— Profile.

Fig. 2.— Ventral view.



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**PLATE 11.**

PLATE 11.

Cranium of a Short-nosed Indian Dog ("Pachycyon") from shell-mound on San Nicolas Island, off southern California, Univ. of Cal., Anthropol. Mus., 1888. Length, occiput to tip of premaxillary, 138 mm.

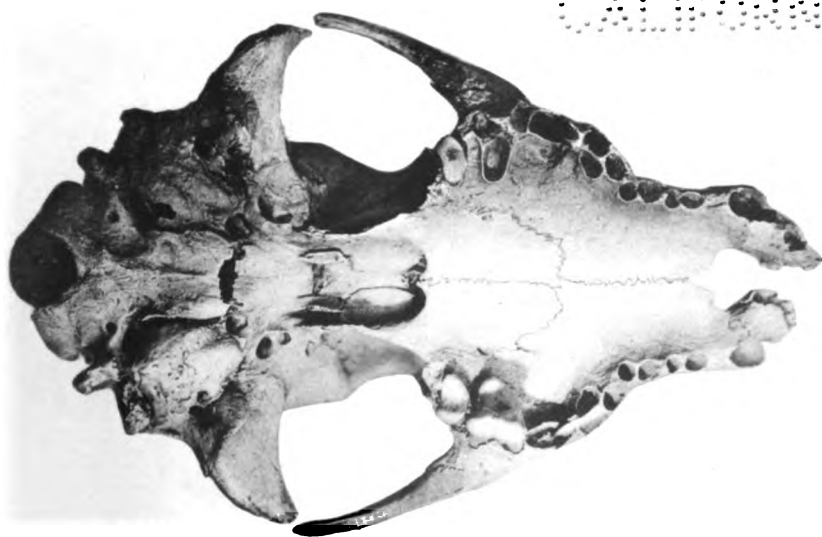
Fig. 1.— Profile.

Fig. 2.— Ventral view.



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**PLATE 12.**

PLATE 12.

Skull of the Peruvian Pug-nosed Dog, collected by Dr. A. Hrdlička at Huacho, Peru, U. S. N. M. 176,307. Length of cranium, occiput to tip of premaxillaries, 147 mm.

Fig. 1.— Profile, showing undershot jaw.

Fig. 2.— Cranium, ventral view.



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REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUTENANT COMMANDER L. M. GARRETT, U. S. N., COMMANDING, PUBLISHED OR IN PREPARATION:—

- |  |   |
|--|---|
| <p>A. AGASSIZ. V.<sup>1</sup> General Report on the Expedition.</p> <p>A. AGASSIZ. I.<sup>1</sup> Three Letters to Geo. M. Bowers, U. S. Fish Com.</p> <p>H. B. BIGELOW. XVI.<sup>11</sup> The Medusae.</p> <p>H. B. BIGELOW. XXIII.<sup>23</sup> The Siphonophores.</p> <p>H. B. BIGELOW. XXVI.<sup>26</sup> The Ctenophores.</p> <p>R. P. BIGELOW. The Stomatopods.</p> <p>O. CARLGREN. The Actinaria.</p> <p>R. V. CHAMBERLIN. XXXI.<sup>31</sup> The Annelids.</p> <p>H. L. CLARK. XXXIII.<sup>33</sup> The Holothurians.</p> <p>H. L. CLARK. XXXII.<sup>32</sup> The Starfishes.</p> <p>H. L. CLARK. XXX.<sup>30</sup> The Ophiurans.</p> <p>S. F. CLARKE. VIII.<sup>8</sup> The Hydroids.</p> <p>W. R. COE. The Nemerteans.</p> <p>L. J. COLE. XIX.<sup>19</sup> The Pycnogonida.</p> <p>W. H. DALL. XIV.<sup>14</sup> The Mollusks.</p> <p>C. R. EASTMAN. VII.<sup>7</sup> The Sharks' Teeth.</p> <p>S. GARMAN. XI.<sup>11</sup> The Reptiles.</p> <p>H. J. HANSEN. The Cirripeds.</p> <p>H. J. HANSEN. XXVII.<sup>27</sup> The Schizopods.</p> <p>W. E. HOYLE. The Cephalopods.</p> <p>W. C. KENDALL and L. RADCLIFFE. XXV.<sup>25</sup> The Fishes.</p> | <p>C. A. KOFOID. III.<sup>3</sup> IX.<sup>9</sup> XX.<sup>20</sup> The Protozoa.</p> <p>C. A. KOFOID and J. R. MICHENER. XXII.<sup>22</sup> The Protozoa.</p> <p>C. A. KOFOID and E. J. RIGDEN. XXIV.<sup>24</sup> The Protozoa.</p> <p>P. KRUMBACH. The Sagittae.</p> <p>R. VON LENDENFELD. XXI.<sup>21</sup> The Siliceous Sponges.</p> <p>R. VON LENDENFELD. XXIX.<sup>29</sup> Hexactinellida.</p> <p>G. W. MÜLLER. The Ostracods.</p> <p>JOHN MURRAY and G. V. LEE. XVII.<sup>17</sup> The Bottom Specimens.</p> <p>MARY J. RATHBUN. X.<sup>10</sup> The Crustacea Decapoda.</p> <p>HARRIET RICHARDSON. II.<sup>2</sup> The Isopods.</p> <p>W. E. RITTER. IV.<sup>4</sup> The Tunicates.</p> <p>G. O. SARS. The Copepods.</p> <p>F. E. SCHULZE. XI.<sup>11</sup> The Xenophyphoras.</p> <p>HARRIET R. SEARLE. XXVIII.<sup>28</sup> Isopods.</p> <p>H. R. SIMROTH. Pteropods, Heteropoda.</p> <p>E. C. STARKS. XIII.<sup>13</sup> Atelaxia.</p> <p>TH. STUDER. The Alcyonaria.</p> <p>JH. THIELE. XV.<sup>15</sup> Bathysciadium.</p> <p>T. W. VAUGHAN. VI.<sup>6</sup> The Corals.</p> <p>R. WOLTERECK. XVIII.<sup>18</sup> The Amphipods.</p> |
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<sup>1</sup> Bull. M. C. Z., Vol. XLVI., No. 4, April, 1905, 22 pp.

<sup>2</sup> Bull. M. C. Z., Vol. XLVI., No. 6, July, 1905, 4 pp., 1 pl.

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<sup>7</sup> Bull. M. C. Z., Vol. L., No. 4, November, 1906, 26 pp., 4 pls.

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**Bulletin of the Museum of Comparative Zoölogy**

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**A NEW FOSSIL CETACEAN.**

**By G. M. ALLEN.**

**WITH ONE PLATE.**

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No. 1.— *A New Fossil Cetacean.*

BY GLOVER M. ALLEN.

IN the course of revising the collection of fossil mammals in the Museum, an unlabeled cranium was found, which was so largely embedded in a hard fine-grained marl, that its true nature was not at first appreciated. The specimen, after this matrix had been carefully chiseled away, proves to be of unusual interest. It lacks the vertex of the brain-case, the jugals, and most of the rostrum including the tooth-bearing parts of the maxillae and premaxillae. What remains, however, is fairly well preserved and clearly pertains to a toothed cetacean of a very primitive type, related apparently to the Eocene *Agorophius*, but differing in certain important details from the only known cranium hitherto referred to that genus. It is therefore doubly unfortunate that so important a specimen should be quite without record of locality, horizon, discoverer, or donor. It lay by itself in a tray without label or catalogue number, having probably been put aside just as received many years ago. The likelihood is that it was sent to Louis Agassiz in the early days of the Museum, possibly from some locality in the southeastern United States, at the time when he was planning a memoir on "*Phocodon*" (see Wyman, *Amer. Journ. Sci.*, 1850, ser. 2, 10, p. 230, footnote). One or two barnacle bases on the upper side indicate that it lay for a time, partly exposed, in the sea.

In the hope that there might be characteristic Foraminifera in the marly matrix, a sample from within the brain-cavity was submitted to Dr. Joseph A. Cushman, who very kindly examined it and reports that "there are a few Foraminifera contained in it, most of which are not well preserved. A few, however, seem to show that the material is probably Upper Eocene (Jackson) in age, and its general appearance would seem to indicate that it came from the Gulf Coastal Plain of the United States, probably from Alabama."

The cranium belonged to a dolphin-like animal, probably some five or six feet long. Obvious peculiarities are its relatively narrow and flattened brain-case, wide mastoid diameter, elongate flattened nasals, parietals forming part of the vertex, the relatively small and prominent occipital condyles, and the long and forward-sloping instead of vertical nasal passage with the remnant of a dorsal chamber above the main part of the nasal cavity. These characters, notwithstanding the lack of corroboration from the teeth, are sufficient to indicate its

relationship to the Mesoceti as defined by Dames (1894). While it possesses several primitive features in common with *Prosqualodon*, its relationship is perhaps nearer to *Agorophius*, with both of which it may be associated in Abel's family, *Agorophiidae*, whose three known members, while perhaps in no case directly ancestral to the more developed *Squalodontidae*, yet indicate previous stages in evolution.

Though quite as primitive in many respects as *Agorophius*, the new fossil shows so many points of difference that it seems worthy of rank as a separate genus.

ARCHAEODELPHIS, gen. nov.

*Diagnosis*.— A long-beaked dolphin-like cetacean; teeth unknown, but apparently long-rooted, probably resembling those of *Agorophius* and *Prosqualodon*; nasals long, narrow, and flattened dorsally; maxillae covering the anterior three fourths of the orbital portion of the frontals; orbit large, with thickened rim and prominent postorbital process; parietals meeting across the vertex of the skull behind the orbits; zygomatic process of squamosal relatively small, with small and nearly horizontal glenoid fossa; mastoid region thickened and produced obliquely downward and backward to or beyond the posterior edge of the condyles which are small and protuberant. Palatals large, expanded anteriorly, separated medially for more than half their length at the back end and by a deep notch at the front end of their combined margin; pterygoids widely sundered, their free margins partly overarching the narial passage. A well-marked nasal chamber is present above the anterior end of the passage, and the vomer forms a cylinder that completely encloses the basal end of the mesethmoid cartilage.

The genus is based on the specimen here described.

ARCHAEODELPHIS PATRIUS, sp. nov.

*Type-specimen*.— A cranium, M. C. Z. 15,749 (Cat. Fossil Mamm.) lacking the bones of the vertex, the jugals, the teeth, and all but the basal portion of the rostrum.

*Locality and horizon*.— Probably from Jackson formation of the Upper Eocene of the southeastern United States, possibly Alabama, as suggested by the Foraminifera from the matrix.



*Description.*— A striking characteristic of the dorsal aspect is the narrow rectangular outline of the nasals whose inner anterior corners seem to have been slightly produced to form a blunt median point. They completely roof over the front end of the nasal passage so that the anterior nares open forward, a primitive character common also to the Archaeoceti. At either side of the nasals appears the base of an intermaxillary, its width about equal to that of a single nasal, its termination at about five eighths the length of the nasal, where it abuts against an anterior prolongation of the frontal. Laterally the proximal end of the maxilla extends back to the level of the base of the nasals, and overspreads about three fourths of the orbital process of the frontal dorsally, reaching the edge of the orbit about half way down

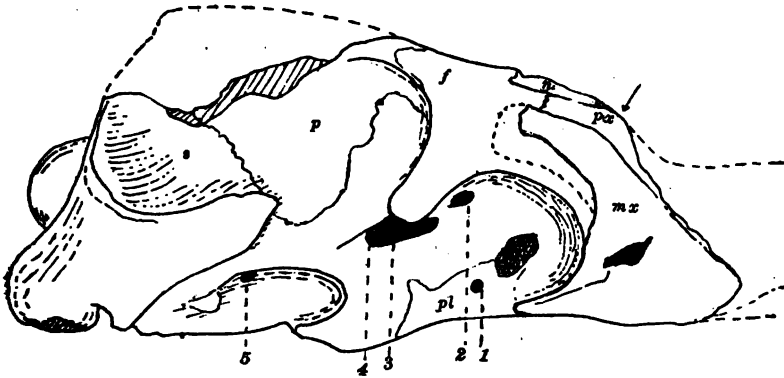


Fig. 1.—Side view of the cranium, from a photograph. *f*, frontal; *mx*, maxillary, part of base (the dotted line shows the limit of its backward extension); *n*, nasal; *p*, parietal; *pl*, palatal, ascending portion; *px*, premaxillary, basal end; *1*, sphenopalatine foramen; *2*, optic foramen; *3*, orbital fissure; *4*, foramen rotundum; *5*, foramen ovale.

on its anterior rim; below this point it forms the front portion of the orbit. Posterolaterally the frontal is produced to form a tapering supraorbital process, whose decurved point is separated from the zygomatic process of the squamosal by about one third the length of the temporal fossa. Its median portion at the point of least interorbital width shows a depression on each side of the cranial axis narrowing to a point forward, which probably received corresponding anterior processes of the parietals. In *Agorophius* there is also a median prolongation of the parietals fitting into a corresponding depression of the frontals but the projection is simple, not bifurcate.

Of the parietals themselves very little remains in the specimen save a portion of the lateral wing of each, (Fig. 1, *p*), whose lower boundary is faintly traceable on the inner wall of the temporal fossa, whence it extends forward as a narrowing border on the posterior rim of the supraorbital process.

In *Agorophius* the highest point of the dorsal profile is formed by the base of the maxillaries, back of which the summit of the skull extends on a nearly horizontal though very slightly depressed plane, to the vertex of the supraoccipital. In *Archaeodelphis*, on the contrary, there was obviously a gradual upward slope of the profile (Fig. 1) which, if the parietals were in place, must have been continued a slight distance to the junction with the supraoccipital, where, as in recent dolphins, the highest point of the profile must have been. This upward slope of the forehead is further indicated by the upward bevel along the edge of the marl matrix filling the brain-cavity, close to the broken edge of the frontoparietal region. The brain-case itself, though relatively narrow as compared with that of modern dolphins, is nevertheless nearly one and a half times as wide as long.

The zygomatic process of the squamosal is relatively weak and ends in a blunt conical point 30 mm. behind the supraorbital process, which slightly exceeds it in size. This is in strong contrast to *Agorophius*, *Prosqualodon*, and modern toothed cetaceans, in which it is large and thickened, and produced forward so as to be nearly in contact with the supraorbital process (in the figure of *Agorophius*, it is seen to be broken near the tip in the only known specimen). Correlated with this difference, is the form of the glenoid cavity for the articulation of the jaw. In *Archaeodelphis* the cavity is nearly flat, and faces almost ventrally, though the posterior border, evidently forming a distinct postglenoid process, appears to be slightly broken away. Medially the articulating surface extends for a distance nearly equal to its length. In *Agorophius*, *Prosqualodon*, and *Patriocetus*, as in the modern dolphins, the articulating surface is relatively larger and includes the concave ventral (or anterior) face of the zygomatic process. This difference evidently implies in *Archaeodelphis* a more precise limitation of the movements of the jaw, to insure a certain amount of shearing action between the opposing sets of teeth, in addition to their seizing function (the main use of teeth in modern cetaceans). Possibly such a cutting action enabled *Archaeodelphis* to feed upon small armored fishes, such as the young of ganoids. It may be regarded as a primitive feature, inherited from the supposed creodont or carnivorous ancestors.

Most remarkable is the development of the exoccipitals and their extension backward, outward, and downward, thereby greatly increasing the massive aspect of the mastoid region. A somewhat similar appearance is shown by *Agorophius* and *Prosqualodon* but in these genera the exoccipitals do not extend so far backward, hardly surpassing the base of the condyles, whereas in *Archaeodelphis* they equal or exceed the protuberant condyles and are produced strongly downward below them.

The occipital condyles are very different from those of modern cetaceans. In the *Delphinidae* their articulating surface is relatively large and almost continuous with the surrounding bones of the occiput so that the head rests firmly upon the atlas with its correspondingly enlarged and flattened anterior facets. In *Archaeodelphis* on the contrary, as well as in *Agorophius* and *Prosqualodon*, they are relatively smaller but very much more protuberant and are set off by a distinct neck or constriction. Their greatest axis is not quite vertical though much more nearly so than in most modern cetaceans, as for example, *Delphinus*. An approach to this condition, however, is found in *Platanista* among the more primitive living forms. This much more primitive condition was doubtless correlated with free instead of fused cervical vertebrae, a fact which, taken in connection with the enlarged mastoid region for muscle attachments, indicates a very much greater mobility of the head both up and down, and sidewise, than in modern cetaceans. Probably with the more forward-opening nostrils, the rostrum rather than the vertex of the head was first thrust above water in breathing, or the front of the head merely elevated from the horizontal position when near the surface, as a seal might do.

Very fortunately the base of the rostrum and most of the lower portion of the cranium were embedded in the matrix, so that it has been possible by clearing this carefully away, to disclose the structure of these important parts. Contrary to the condition shown by the type-specimen of *Agorophius* in which the nasals, intermaxillaries, and vomer seem to have been loosely attached, and have become lost, these bones in *Archaeodelphis* are strongly soldered together. A very remarkable and interesting development of the vomer and adjacent bones is seen in a front view of the rostrum (Fig. 2) which in the specimen is broken short off so as to give nearly a vertical section. The dorsal three fourths of the premaxillaries are considerably thickened with outward-flaring inner faces bounding the sides of the nasal opening. Their ventral fourth encloses the vomer whose lateral wings are here expanded to form a cylindrical tube, containing the mesethmoid

cartilage. This tube was obviously continued forward with its supporting rod of cartilage to give strength to the rostrum, as in the Denticeti. At its base, the tube separates the two intermaxillaries medially for a space of 9 to 14 mm. and is continued dorsally as a thin knife-like partition quite to the under side of the nasals, so as to divide the nasal chamber longitudinally. There appears to be also a vertical wing on each side lining a portion of the outer wall of the nasal opening. Ventrally, the vomer is continued as a median keel from the rostral cylinder and appears on the palatal aspect as a narrow line separating the maxillaries. Viewed from the posterior narial opening,

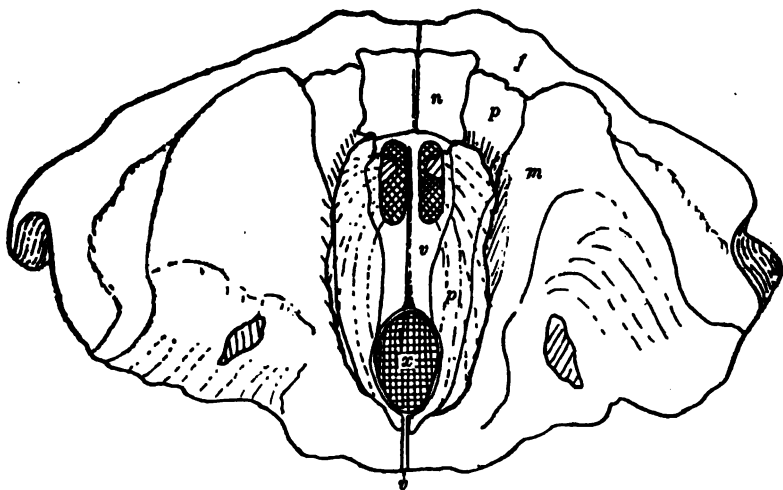


Fig. 2.—The cranium in front view, from a photograph. *f*, frontal; *m*, maxillary; *n*, nasal; *p*, premaxillary; *v*, vomer, forming a rostral tube to enclose, *z*, the mesethmoid cartilage.

the backward extension of this tube is seen to become laterally compressed, and continuing its course in the plane of the palate, abuts against the wall of the nasal cavity some 30 mm. from the opening of the posterior nares. With the apparent exception of *Ceterhinops*, no similar rostral tube is known in other cetaceans, for, as in *Pro-squalodon* (Abel, 1912) it is usually open dorsally at the base and the mesethmoid cartilage, more or less ossified, appears at the base of the rostrum between the intermaxillaries.

The posterior part of the narial passage is flattened dorsoventrally,

with divergent sides, and is largely enclosed by the arching palatals and the incurved pterygoids, except medially where these bones are separate below. Behind the pterygoids the narial passage viewed from below, is continued as a broad shallow trough with raised and slightly divergent sides, nearly to the foramen magnum, much as in modern dolphins, except that this portion of the narial passage lies nearly in the plane of the palate instead of being bent at an angle with it. This angle is obvious in *Agorophius* (True, 1907, plate) as well.

The palatal region, so important for its diagnostic characters in the Cetacea, is beautifully preserved except for the tooth-bearing parts of the maxillaries. In most extinct cetaceans, however, this aspect of the skull is seldom preserved or figured so that full comparisons are not as yet possible. In the specimen, only the basal portions of the maxillaries between the tooth-rows remain. Here a slight longitudinal groove-like depression is indicated on each side of the median line, corresponding perhaps, with the shallow palatal grooves seen in *Delphinapterus*. The palatal bones are perfect and lie in a plane very slightly depressed from that of the maxillaries. As usual in Cetacea, as well as in seals, the tooth-rows lie anterior to the front margin of the palatals. Each palatal is expanded at its forward end, where its outline is strongly convex, so that there is a distinct emargination at the median portion of their combined front edges. Together they nearly fill the space between tooth-rows, and are in contact medially for a trifle less than one third their length before diverging evenly at their posterior ends. At the ventral edge of the orbit each sends up a dorsal branch at right angles to the palatal portion. Just above this edge and close to the anterior margin of the ascending wing is a small but distinct sphenopalatine foramen (Fig. 1, 1).

The pterygoids are relatively small, their ventral portion incurved so as partly to embrace the opening of the posterior nares. They are widely separate and their posterior margins divergent.

Laterally, on either side of the trough that continues the narial passage, is a deep groove with sharply defined boundaries, extending forward as far as the pterygoid bone. About half way on the length of this groove opens the large foramen ovale, (Fig. 1, 5) its course continued laterally as a shallow furrow. The orbit shows three large foramina for nerves. Slightly above and in advance of its center is the optic foramen of relatively small size (Fig. 1, 2). Below and behind this is the very large orbital fissure (foramen lacerum anterius) deeply excavated in the wall of the orbit, while close against it postero-externally, and separated only by a thin bony partition is the fora-

men rotundum (for the second division of the fifth nerve) lying in the same deep groove with the orbital fissure (Fig. 1, 3 and 4).

What appears to be the opening of the lachrymal canal lies just below and ahead of the optic foramen, where the outline of a small lachrymal bone can be faintly traced, wedged in between the ascending process of the palatine and the base of the orbital portions of frontal and maxillary. The antorbital foramen perforates the latter just exterior to the lachrymal, and appears in the section of the broken rostrum as a large triangular orifice with its point directed downward.

The tympanic bullae are lost, and were evidently but loosely attached as is usual in Cetacea. The petrous and mastoid portions of the ear-bones, however, are still present, and as in some of the more primitive existing cetaceans, (*Balaena*, *Platanista*) are firmly wedged between exoccipital and squamosal. The petrosum is small ( $17 \times 11.5$  mm.), roughly egg-shaped, with its long axis directed anteroposteriorly, and lies close against a bony eminence bounding the inner side of the glenoid fossa. The mastoid portion (28 mm. long) extends obliquely outward and backward to the periphery, expanding to a width of 20 mm. where it reaches the outer surface of the cranium. A notch separates it from the post-glenoid process.

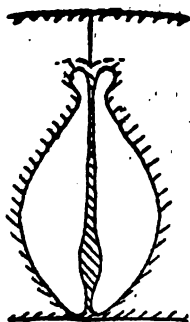


Fig. 3. — Diagrammatic cross-section of nasal passage at base of rostrum, to show the vestibial dorsal nasal chambers.

The nasal cavities are fortunately preserved intact and were, with some difficulty, quite cleared of matrix on one side of the median septum formed by the vomer. The greater part of their vertical diameter is taken by the narial passage itself which extends from the laterally compressed anterior opening, obliquely backward and downward, expanding laterally as it approaches the posterior nares. Directly back of the anterior narial opening and wholly above the air-passage itself, is a pocket extending backward and nearly cut off below by a blunt projection of the outer wall of the cavity, so that a distinct dorsal division of the nasal chamber (Fig. 3) is formed, a primitive feature of which no vestige remains in modern cetaceans. Stromer (1903, pl. 11, fig. 1-3) has shown sections of the nasal cavity of *Zeuglodon* (*Basilosaurus*) *zittelii* in which there is a much better developed olfactory chamber, similarly situated, and wholly cut off ventrally from the main air-passage by a *lamina terminalis* extending inward

from the outer wall of the cavity. He found also indications of naso- and maxillo-turbinals. It is therefore probable that the blunt projection from the outer wall of the nasal cavity, above referred to, is the remnant of a *lamina terminalis*, but there is no indication of turbinal bones, which probably had atrophied.

*Measurements.*—The following dimensions indicate the size of the cranium:

	mm.
Tip of nasals to end of occipital condyles .....	180
Front edge of palatal bone to same point .....	158
Anteroposterior length of temporal fossa .....	92
Length of right orbit .....	54
Length of nasals .....	41
Combined width of nasals .....	38
Width across front of orbits .....	145
Mastoid width .....	180
Least width between temporal fossae .....	64
Combined width of palatal bones .....	69
Width across occipital condyles .....	57
Approximate width across supraorbital processes (twice one half) .....	190
Height of muzzle at tip of nasals .....	70

#### SUMMARY OF RELATIONSHIPS.

Of primitive cetaceans whose skull characters are sufficiently known to admit of comparison with *Archaeodelphis*, three genera stand out as bearing a considerable degree of similarity to it, namely, *Agorophius*, *Prosqualodon*, and *Patriocetus*. The first of these, with the single species *A. pygmaeus*, is still known from the type-specimen only — now lost — the history and peculiarities of which have been fully set forth by True (1907). Although the intermaxillaries and nasals as well as most of the inferior side of the cranium of this specimen were not preserved, still it bears obviously a general superficial resemblance to *Archaeodelphis* in the somewhat flattened profile, the great anteroposterior extent and the breadth of the temporal fossae, and the resulting narrowness of the region separating the two fossae anteriorly. This narrow isthmus in both genera, is formed dorsally by the parietals which instead of being excluded from the peak of the cranium as in modern cetaceans, meet behind the frontals at the dorsal line. Further points of resemblance are found in the shape of the brain-case and in the great lateral extent of the orbital portion of the frontal with its well-developed and tapering postorbital process.

Both species, further, have small and prominent occipital condyles, indicating a considerable mobility of the head. On the other hand, *Archaeodelphis* differs from *Agorophius* in many important characters, both primitive and progressive. Thus its basicranial axis is not bent at an angle with the plane of the palate, whereas in *Agorophius* the fragments of basioccipital and basisphenoid remaining, clearly form a distinct angle with the palate, foreshadowing the considerable angle seen in many modern dolphins; again, the zygomatic process of the squamosal is but weakly developed in *Archaeodelphis* whereas in *Agorophius* it is large and well arched for the extensive jaw-articulation, in addition to being much more produced forward. On the other hand, *Archaeodelphis* is the more progressive in its higher vertex and shows a special development of the mastoid region downward and backward. A comparison of nasals, intermaxillaries, and vomer is not possible, but since these parts are lost in the type-specimen of *Agorophius*, it may be that they were less solidly fused than in *Archaeodelphis*. In the latter, the extraordinary formation of the vomer, completely enclosing the mesethmoid cartilage in a tube and dividing the nasal cavity by a thin bony septum is possibly a specialization; while the retention of elongate, narrow nasals well solidified with the surrounding bones and a distinct olfactory chamber dorsal to the main air-passage are primitive characters.

From his study of the three known specimens of *Prosqualodon*, from the Miocene of Patagonia, Abel (1912) has shown, that although possessing many primitive characters, such as the low vertex, narrow brain-case, broad zygomatic processes, parietals meeting at the vertex behind the frontals, and large temporal fossae, it shows nevertheless a great advance over *Agorophius* in many respects, and though hardly ancestral to *Squalodon*, yet foreshadows many of its delphinoid characters, such as the reduction of the nasals, the greater anteroposterior compression of the cranium, more nearly vertical nasal passages, and relatively smaller temporal fossae. Its teeth Abel interprets as being more specialized than in the squalodonts, and as a further progressive character, the intermaxillaries are toothless. It has a well-marked maxillary notch as in squalodonts and modern dolphins.

In comparison with *Patriocetus*, a new generic term proposed by Abel (1912, p. 69) for *Squalodon ehrlichii*, *Archaeodelphis* is at once distinguished by the absence of the pronounced overhanging ledge that partly roofs over the front end of the temporal fossa, somewhat as in the zeuglodonts (*Basilosaurus*). The zygomatic process of the squamosal is large as in *Agorophius* and *Prosqualodon*, and as in the



former the dorsal profile of the brain-case is nearly flat. The basi-cranial axis seems to be bent slightly to form an angle with the plane of the palate. As True (1907) had previously indicated, this cetacean seems very different from typical *Squalodon*, though its characters are still imperfectly known. The recent discovery of a well-preserved example in the upper Oligocene at Linz (König, 1911) should help to elucidate its relationships when the promised studies of Dr. Abel on this important specimen are published.

There seems to be no close relationship between *Archaeodelphis* and the zeuglodonts, which, as lately shown by the studies of Dames (1894), Stromer (1903), Fraas (1904), and Andrews (1906), appear to be only remotely connected with the more typical cetaceans (*Mesoceti* and *Denticeti*) if not a wholly independent offshoot from a primitive creodont stock. They reached their maximum development in both size and skeletal modification during Eocene times, and then became extinct. Their ancestry, however, seems to be clearly indicated through the discovery by Fraas (1904) of the skull of a small species (*Protocetus atavus*) from the lower Middle Eocene of Mokattam, near Cairo, Egypt. This was a primitive surviving type, contemporaneous with more evolved types that inhabited the same Eocene seas. Its dentition, however, instead of exhibiting the usual compressed premolars and molars with serrate edges, is like that of a typical creodont.

So far as can be judged from the specimen here described, *Archaeodelphis* stands as a very primitive cetacean, probably nearest related to *Agorophius* of known forms, and to be associated tentatively with it in a separate family, *Agorophiidae*. It represents a dolphin-like animal belonging in a general way to a type ancestral to the *Squalodontidae* and through them to the more modern *delphinoids*.

A word may be added as to Leidy's genus *Ceterhinops*. This was founded on a fragment of a cranium which included portions of maxillae, premaxillae, vomer, and frontal. The vomer formed at its base, a cylindrical tube, much as in *Archaeodelphis*, and this was continued dorsally as a thick bony septum quite separating the nasal passages. The figure given by Leidy (1877, pl. 34, fig. 7) indicates, however, a skull of different configuration, perhaps lacking such nasal bones as *Archaeodelphis* possessed, and having the basal ends of the premaxillae tapering to a point between the frontal and the maxillae. Its fragmentary nature renders a further comparison difficult, but indicates a possible relationship. Leidy's specimen came from the Ashley River phosphate beds of South Carolina.

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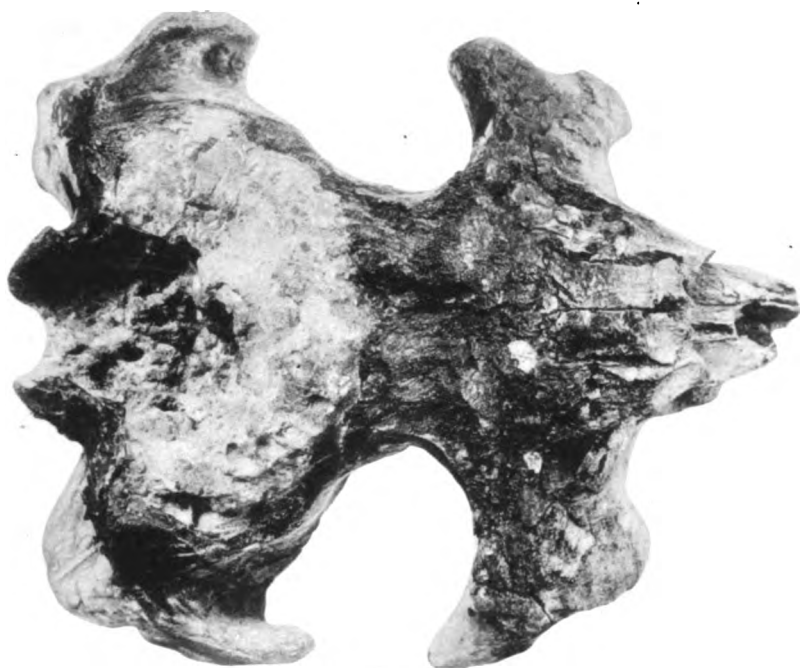
1907. Remarks on the type of the fossil cetacean *Agorophius pygmaeus* (Müller). Smithson. contr. knowl., 8 pp., 1 pl.

**EXPLANATION OF THE PLATE.**

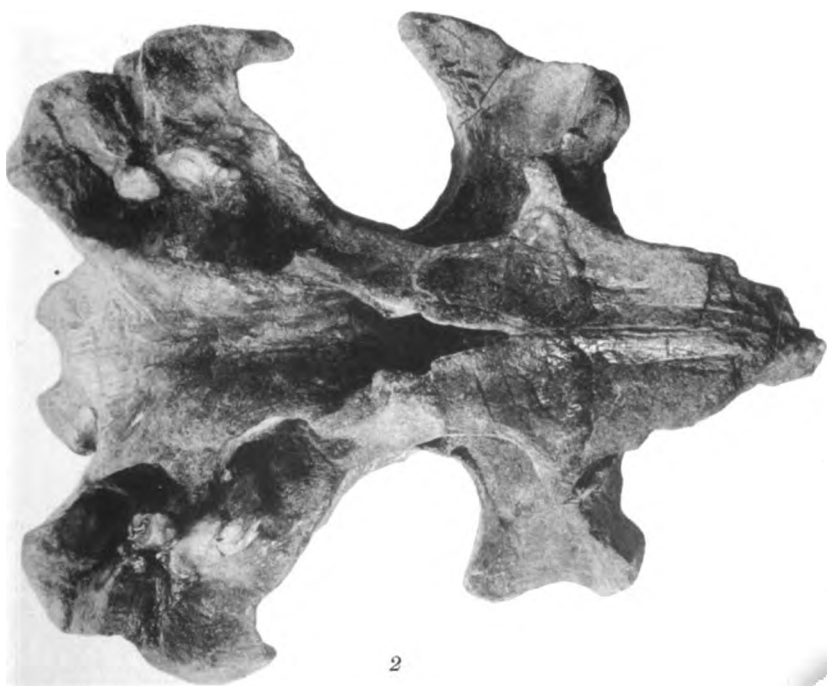
EXPLANATION OF THE PLATE.

*Archaeodelphis patrius* Allen.

- Fig. 1. The type-cranium from above.  
Fig. 2. The same from below.



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[From 'The Auk,' Vol. XXXVII, No. 4, October, 1920.]

**PATTERN DEVELOPMENT IN TEAL.**

**BY GLOVER M. ALLEN.**

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## PATTERN DEVELOPMENT IN TEAL.

BY GLOVER M. ALLEN

AN article by Mr. Frederic H. Kennard in 'The Auk' for October 1919, describing and naming the Southern Blue-winged Teal as a distinct subspecies, brings out a point of considerable evolutionary interest, which it seems to me is worth emphasizing. The chief mark of the newly recognized race is the presence of a white superciliary stripe continuing the white crescent between the eye and bill, characteristic of the common Blue-winged Teal, and the two stripes, one on each side, meet at the back of the head and are continued medially to form a white nuchal patch of varying extent. This unusual extension of the white crescentic mark is found in the adult males only and is characteristic of the completely developed nuptial plumage in the Southern birds. A similar, though often irregular line, is sometimes seen in partially white domestic pigeons and ducks.

The formation of a definite pattern of pigmented (*i. e.*, colored) and pigmentless (*i. e.*, white) areas, particularly in birds and mammals, is a subject which has greatly interested me, and in an article in the American Naturalist (vol. 48, p. 385-412, 467-484, 550-566, 1914) I have endeavored to establish that in these two classes of vertebrates, white markings when present tend to occur in certain definite places. This is due to the fact that the surface

of the body may be divided into some eleven areas from whose individual centers the tendency to produce pigment in the epidermal structures (hair or feathers) tends to become less and less as the periphery of the particular area is reached. These areas may bear some as yet unrecognized relation to the distribution of nerves. The borders of contiguous areas may overlap, and the details of their topography in different mammals and birds may vary, but in general their outlines are fairly definable as follows:

(1) a *median crown patch*, in birds pigmenting the top of the head from base of beak to occiput above the eyes; (2) an *ear patch* on each side covering the side of the head and upper throat from the level of the eye to the median line above and below; (3) a *neck patch* on each side pigmenting the area from the upper throat to the shoulders; (4) a *shoulder patch* on each side pigmenting the feathers of the wing and a narrow area at its base from center of back to center of breast; (5) a *side patch* on each side of the body which includes the area from shoulder to rump; and (6) a *rump patch* on each side which pigments the posterior end of the body, the tail, and most or all of the hind leg. These patches are outlined in the accompanying diagram (Fig. 1). I have called these color areas primary patches. They may break up further to form complex patterns.

The definition of these patches is sometimes complicated by two (or three?) other types of pigmentation which in some species co-exist with this *centripetal* type—namely, a diffuse pigmentation from many small independent centers, producing the spotted effect seen for example in the Dalmatian Coach Dog, and a *centrifugal* type, which produces black “points” at tips of nose, ears, limbs or tail in certain species. A black median area on the spine is perhaps a manifestation of this same type. These three types of pigmentation behave differently in heredity and have been studied lately by several geneticists. It is likely that the median crown patch, very small in mammals, may really consist of two bilateral centers, here in close juxtaposition for in birds it is frequently divided by a white median line, though in the few mammals where I have seen it (*e. g.*, dogs) it is not so divided.

From a study of pied individuals of species which normally have complete pigmentation, it is found that the white markings

tend to occur at the peripheries of the pigment centers as above defined, and result from the failure of pigment to develop at the edges of these centers. The more the pigmentation is restricted, the greater is the amount of white between the respective centers. If each patch or center were to be *slightly* reduced, a series of five pigment spots on each side, and one on the crown would result, bounded by white lines—a median white line from the occiput to tail, and cross stripes separating the five patches of each side. A much greater but regular restriction of each patch would result in reducing the pattern to a series of five small spots on each side with a single median one on the crown; and still further reduction brings about a pure white condition with black eyes—(possibly

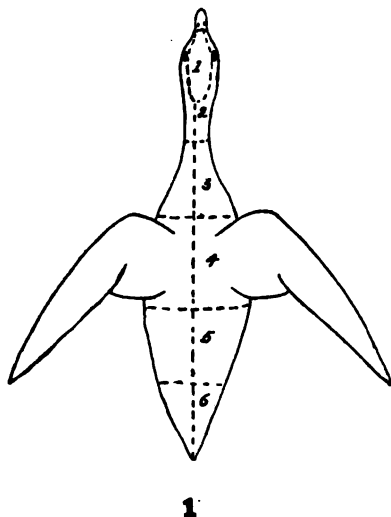


Figure 1.—Diagram showing chief pigment areas of a bird's body, from above.

the eyes being in part of ectodermal origin, should themselves be regarded as an additional pair of pigment centers). Such white animals with black eyes occur as artificial breeds in a number of species, and on account of their possessing a potential pigmentation, act as pigmented individuals in crosses with true albinos which do really lack the pigment-producing factor. Actually there is great variation in the amount of reduction, for not only

does each spotted individual differ in the extent of its pigmented areas, but corresponding areas of opposite sides vary in the amount of reduction in the same individual, so that often the contiguous patches of one side may show a white break between them, while those of the opposite side retain contact.

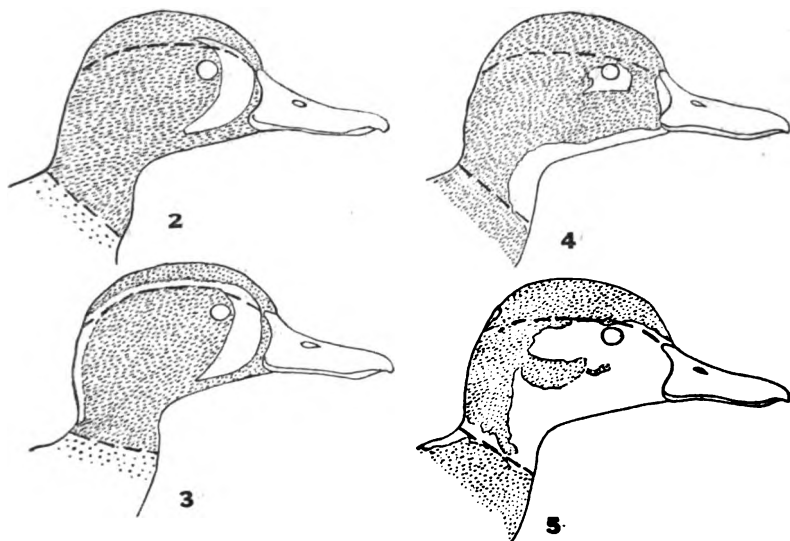


Figure 2.—Head of Blue-winged Teal, to show pattern. In this and the other heads, the approximate outline of crown patch and the boundary between ear and neck patches, are shown by a heavier dotted line.

Figure 3.—Head of Southern Teal, showing extension of white pattern through restriction of ear patch dorsally and posteriorly.

Figure 4.—Andaman Teal (*Polionetta albigularis*) showing slight reduction of ear patch.

Figure 5.—White-cheeked Andaman Teal (*P. a. leucopareus*) showing incomplete formation of a white collar by failure of ear patch to meet the upper end of neck patch.

But to return to the Teal, the point of interest is that the white crescentic mark of the normal bird is due according to this view, to a restriction of the ear patch (whose ultimate center is the aural region) at its front end, so that a pigmentless area is left at the base of the bill (Fig. 2). The head pattern of the common Blue-

winged Teal has developed no further. In the Southern Teal, however, (Fig. 3) a further restriction of the ear patch has taken place, producing a complete line of separation between it and the crown patch, so that a white superciliary line results from the failure of these two patches to develop pigment at their common border; and in those individuals that show a white nuchal area, this restriction has involved also the posterior extension of the ear patches of opposite sides so that a white streak results when they fail to meet along the median line of the neck. Obviously this condition, with its more complex pattern, represents a more highly evolved plumage than that of the Common Blue-winged Teal. It is, therefore, not unexpected that it should occur only in the most highly developed or nuptial plumage, at the time when the bodily vigor is most intense. It may be well to add here that the presence of albinistic or white areas does not imply, as many suppose, an impaired bodily vigor, but merely a specialized condition of the factor producing pigment in the epidermis. The fact that the amount of white in the pattern of many natural species is very variable, indicates, I presume, that its areal development has not come under a strong selective force so that the boundaries of the white areas have not become fixed. That the white head-marking of the Southern Teal is of a fairly definite nature, may show, conversely, that it *has* become a factor in this bird's welfare and is tending to be symmetrically developed as part of a definite pattern. For this reason the extension of the usual white area is of value as a diagnostic mark of the more southerly breeding Teal.

On my expressing to Mr. Kennard an interest in this bird, he has kindly called my attention to an observation of Mr. Stanley C. Arthur (since published in 'The Auk') who has for three years past kept in confinement in the flying cage of the Audubon Park, New Orleans, one of these Southern Teal, showing the characteristic "necktie" marking. In the spring following its capture, this drake molted into the nuptial plumage, but the white superciliary line and nape patch seemed less definitely white than Mr. Arthur's recollection of them the year before. In the next year, however, when the bird again assumed its spring plumage, neither the white line nor the white nape patch was apparent. The bird's

death occurred shortly after, in April of that year. This interesting case only serves to emphasize still further that this "necktie" pattern is a newly acquired character in the phylogeny of the race, and in the growth of the individual is assumed at the time of its highest physiological development. The fact that the captive bird finally lost this marking may have been due to impaired vigor, either as a result of old age or as a result of the abnormal conditions of captivity, which as is well known, nearly always result in interrupting the usual course of physiological processes. If due to senescence, it is paralleled by numerous other cases in both vertebrates and invertebrates. A familiar one is the "going back" of deer antlers in old males.

The Southern Teal is not the only duck that might be cited as a case of formation of a distinct geographical race through the differential development of white areas in the plumage by restriction of pigmentation. Mr. Outram Bangs has called my attention to the case of the Teals of the Andaman Islands, *Polionetta albigularis*, in which (Fig. 4) the ventral side of the throat and a spot just below the eye are white, showing thus only a slight restriction of the ear patches ventrally and about the eye. In one of two specimens from the same locality, however, white feathers appear at the base of the bill, and the white mark below the eye is much larger than in the other, indicating that the pattern is still in an unstabilized condition. The development of white areas thus begun, is carried still further in the race *P. a. leucopareus* from North Reef Island, in the same group, in which the restriction of the ear patches is so extensive (Fig. 5) that the upper throat and side of head to the level of the eye are white as far back as the ear opening, and a white collar has resulted through failure of the ear patch to reach the upper edge of the neck patch. Behind the ear, the crown patch is still united with the ear patch except at the occiput, where a very small white spot occurs in one of the two specimens seen. One might conceive of a further stage in evolution of this pattern, whereby the crown patch would persist intact, but the ear patches dwindle perhaps to a very small spot over the ear opening. Such a pattern is found in the Old-squaw female in winter. A subsequent loss of the crown patch would then leave a head pattern similar to the adult male Old-squaw.

Dr. John C. Phillips tells me that the Congo Teal shows very beautifully in a series of specimens from the same general region, a variation in the degree of restriction of the individual pigment centers. The common Mallard as I have shown in the article above cited (*Am. Nat.*, 1914, vol. 48, p. 483) frequently shows under domestication, the development of white superciliary lines that correspond in position with white areas which have in other species become a permanent part of the pattern. The normal male Mallard has in the fully developed plumage, a white collar at a point bounding the upper limit of the wine-colored neck. This is merely the development of a white area at the point of contact between the ear patches covering the sides of head and upper throat, and the neck patches pigmenting the lower throat. (Here the two sets of patches are of different colors.) In the domesticated Black Mallard this white ring is often absent, on account of the complete development of the two sets of pigment patches. I have also seen a female Mallard in which a white half-ring was present as an albinistic spot in just the place where it is completely developed in the male, showing that this is one of the contact points between two pigment centers, a place of least color formation, where, if restriction of pigment areas takes place, a white mark will first result. Indeed the Anatidae seem especially favorable for a more intensive study of this method of pattern formation, and well merit special investigation as to the development and transmission of partial pigmentation. Already careful studies of rats, mice, guinea-pigs and rabbits have been made by geneticists on these lines, and it is to be hoped that comparative studies on birds will follow.

*Boston Society of Natural History, Boston, Mass.*



## BATS FROM MOUNT WHITNEY, CALIFORNIA

BY GLOVER M. ALLEN

In July, 1915, it was the writer's privilege to accompany Prof. Theodore Lyman on a brief expedition to Mount Whitney, the highest peak in the United States outside of Alaska, lying near the southern end of the Sierra Nevada of California. Starting from Lone Pine, at the eastern foot, we ascended to the upper limit of timber and there camped for a week or more by the outlet of a mountain lake, at an altitude of about 11,000 feet. In successive evenings, four species of bats were secured at this camp, one of which proves to be an unsuspected new species, apparently related to *Myotis lucifugus*. The following brief notes are further offered as amplifying slightly the distributional data lately published by Mrs. Hilda W. Grinnell in her excellent Synopsis of the Bats of California (Univ. of Calif. Publ., zool., 1918, vol. 17, p. 223-404, pl. 14-24). All the specimens obtained were, through Doctor Lyman's generosity, given to the Museum of Comparative Zoölogy, at Cambridge, to the authorities of which I am indebted for permission to publish this report.

### *Myotis yumanensis sociabilis* H. W. Grinnell

#### TEJON BAT

This form of the Yuma bat is characterized by Mrs. Grinnell as intermediate in color between typical *yumanensis* and its subspecies *saturatus*. She indicates its range as the "semi-arid Transition and Sonoran zones in [southern] California west and north of the southeastern deserts." On July 16, a bat which seems referable to this race was shot just above our camp at 11,000 feet on Mount Whitney,

the highest recorded altitude for it in the state (though Mrs. Grinnell records one from 8500 feet in the San Bernardino Mountains). A second individual was captured at Lone Pine at the foot of the mountain, a few days later. Both are males.

In her Synopsis of the Bats of California, Mrs. Grinnell cites but a single specimen of typical *yumanensis* from that State, namely, one from Carroll Creek, Inyo County. In view of the implied distribution of this form east of the desert divides, I at first was inclined to refer the above specimens to it, but thanks to the generous interest of Mr. A. Brazier Howell, of Covina, California, I have been able to compare them with typical *yumanensis* from near Potholes, a short distance from Fort Yuma, Imperial County, the type locality. The skin from Mount Whitney is noticeably darker, with slightly darker membranes, thus inclining toward the race *saturatus*. There is a very notable difference, apparent in both skin and alcoholic, by which the two specimens from Inyo County are further distinguished, namely, the much larger thumbs with their longer, more curving claw. The thumb of typical *yumanensis* is nearly 1.5 to 2 mm. shorter, a difference very apparent on comparison. Although direct comparison with typical specimens of *sociabilis* has not been made, it is clear that our Mount Whitney and Lone Pine examples cannot be referred to *yumanensis* proper, and hence doubtless represent *sociabilis*, the subspecies intermediate in position between it and *saturatus*.

### ***Myotis albicinctus* sp. nov.**

#### **WHITE-EDGED BAT**

*Type*.—An adult male, skin (and skull, temporarily mislaid), 11747 Mus. Comp. Zool., from 11,000 feet altitude at the upper limit of timber, Mount Whitney, California, July 14, 1915.

*Characters*.—A bat of the size and proportions of *M. lucifugus* but very pallid, with conspicuous white border to the wing membranes, broadest between the fifth finger and tarsus. Skull like that of *M. lucifugus* but the two small anterior premolars of the upper jaw relatively larger, the first drawn decidedly within the posterior border of the canine, by which it is thus partly concealed in side view.

*Color*.—The type is a very pale clear sandy above, nearest the "pale buff" of Ridgway's 1912 Nomenclature of Colors, very slightly paler or grayer on the head; below clear and contrasting white, the gray bases of the hairs showing through on the throat. The basal portion of the fur of both surfaces is dark slaty, paler or grayish at the throat.

The ears are blackish as is also the greater part of the wing membranes. The posterior edge of the wing from the tip of the longest (third) digit to the ankle

has a pronounced white border, narrow at the tip of the wing and not sharply defined, but from the tip of the fifth finger to the tarsus, it is broad (1.5 mm. in the dry skin), very sharply and contrastingly marked off. The uropatagium is dusky on the basal third, passing into whitish on the distal two thirds, with a clearer white edge.

*Membranes.*—The ears and tragus are practically as in *M. lucifugus*, and minutely haired. The fur of the body extends very slightly on to the base of the uropatagium, but is sharply limited at the sides of the body. The foot is relatively large as in *M. lucifugus*, the calcar long and slender, unkeeled, ending in a minute projecting lobule. The extreme tip of the tail is free.

*Skull.*—Unfortunately the skull of the type has been temporarily mislaid. The skull of a second specimen, however, (1023, coll. of A. B. Howell) from Mono County, California corresponds closely in size and shape with that of *M. lucifugus altipetens*, but is at once distinguished by the relatively larger and blunter first and second upper premolars ( $pm^1$ ,  $pm^2$ ). In *M. lucifugus* and its western race both are fully visible in side view, and stand practically in the line of the tooth row, the posterior tooth with perhaps one half the cross-section area of the anterior. In *M. albicinctus*, however, the larger anterior tooth is distinctly drawn in from the tooth row and shifted slightly forward, so that the anterior third of its base is nearly concealed by the base of the canine when viewed in profile. The second premolar is distinctly larger relatively, in cross section, than in *M. lucifugus*. As in the latter, and in contrast to *M. subulatus*, the lower incisors are but very slightly imbricate.

*Measurements.*—The type measured before skinning: total length, 86 mm.; tail, 42.5; hind foot, 9; ear from meatus, 15; forearm, 37; tibia (dry), 16. The specimen collected by Mr. A. B. Howell in Mono County, California, measured: total length, 91 mm.; tail, 41; hind foot, 11; ear, 14; alar expanse, 255. Its forearm measures 38 mm., tibia, 17.5.

The skull of the latter specimen (1023, coll. A. B. Howell), measures: greatest length, 15; basal length, 12.5; palatal length, 7; upper tooth row,  $i^1$  to  $m^2$ , 6.5; width outside  $m^2$ , 5.8; interorbital width, 3.8; zygomatic width, 9; mastoid width, 7.5; lower tooth row,  $i_1$  to  $m_2$ , 7.

*Remarks.*—This very beautiful new species is at once distinguished from any of the described forms of North American *Myotis* by its pale buff coloration above, contrasting with the white lower surface, and by the conspicuous and sharply defined white border of the wing membranes, and the silvery uropatagium.

The type was shot at dusk as it was flying down the slope above our camp at 11,000 feet on Mount Whitney. The locality was just above a clump of pines that formed the upper limit of timber at the lower end of a large valley encroaching upon the main peak. A rushing mountain stream dashed past at this point and a large snow bank still remained near by in mid-July.

The skull of this specimen after brief examination, was put aside for cleaning but has been unfortunately mislaid. I had hesitated to de-

scribe the species without comparison of the skull, but the capture of a second example at Mammoth, Mono County, California, by Mr. A. Brazier Howell of Covina, California, has happily made this possible. Both Dr. and Mrs. Joseph Grinnell, who have seen these two skins, were inclined to refer them to *M. lucifugus altipetens*, though recognizing that they are quite different. Mr. Howell has very generously loaned me his specimen (taken on August 2, 1917) and it agrees in every essential with the type, showing the same pale buffy coloration above, pure white below, and conspicuous white border to the wing membrane. In the dry skin, the uropatagium is a trifle darker owing to its not being as completely spread. The beautifully prepared skull has made possible a description of the conspicuous difference in the upper premolars as compared with *M. lucifugus altipetens*, a specimen of which, identified by Doctor and Mrs. Grinnell, the Museum has from Mount Tallac, California. In size and details of external structure this species very closely resembles *M. lucifugus* and *M. l. altipetens* but in its coloration and in the relations of the first two upper premolars it is widely different and is unquestionably a wholly distinct species. As lately shown by Mrs. Grinnell, the race *altipetens* is clearly only a pallid subspecies of *Myotis lucifugus*, from which it chiefly differs in its tawnier coloration. The dark shoulder spot is a distinguishing mark of the species, but no trace of such a contrasting spot is found in *M. albicinctus*.

The pallid coloration of this bat may indicate that its main range is in the desert country chiefly east of the Sierras.

### ***Myotis longicrus interior* Miller**

#### INTERIOR LONG-LEGGED BAT

Two males were shot on different evenings (July 14 and 17) at our camp at 11,000 feet. One is much darker in coloration than the other, apparently an immature though full-sized individual. The other is a brighter tawny-olive than a specimen from Hot Springs Pass, Mono County, in the Museum collection, taken as representing typical *longicrus*. I have followed Mrs. Grinnell in referring both to the subspecies *interior*. In her Synopsis of the Bats of California, she records it from the "arid Upper Sonoran, Transition, and lower Canadian zones" from Mono County southward. The present capture extends the limits of range to a record altitude. Our first specimen was shot shortly after sundown while it was flying about among

the tops of the pines surrounding the camp. The flight is rather slow and weak as compared with that of *M. lucifugus*. In addition to its longer tibia and smaller hind foot, this species is easily distinguished from the *lucifugus* group by its well-keeled calcar.

### *Eptesicus fuscus* (Beauvois)

#### LARGE BROWN BAT

At our 11,000-foot camp, one or two large brown bats were seen nearly every evening, distinguished by their size and relatively slow steady flight. Of those shot only one, an adult male, was retrieved. It is quite identical in color with two females shot at Lone Pine, at the base of the mountain, and is not to be distinguished from eastern skins. Thus the wide geographical range of the species corresponds with its altitudinal distribution.

*General remarks.*—It is probably significant that all five specimens obtained at 11,000 feet on Mount Whitney, representing four species of bats, are males. The presence of *Myotis longicrus interior*, *M. yumanensis sociabilis*, and *Eptesicus fuscus* above the Transition or Lower Canadian zones appears to be unrecorded in California, yet all three were collected in what would be considered for ground-living mammals, a boreal (Hudsonian) zone. This wide range in altitudinal distribution implies a certain disregard for the zonal limits which is probably due to temporary increase in distributional area of insect life, causing a temporary invasion by bats from the lesser altitudes. As recorded by Mrs. Grinnell, of sixty-one bats of the race *Myotis yumanensis sociabilis* collected at Fort Tejon, July 21 to 25, all the adults were females, thus indicating, as Mrs. Grinnell suggests, "that with the approach of summer the full-grown [adult] males leave the colony and forage singly at higher elevations." That the breeding females are more strictly confined to their proper "life zones" seems likely and is corroborated by our observations on Mount Whitney, where the few specimens taken proved to be males. It is well known that the upper levels of mountains abound in insects, many of which are wafted up by convectional diurnal air currents from below, so that during the midsummer period they would form an attraction to insectivorous bats, and thus afford cause for a local and seasonal invasion by the non-breeding individuals. It was unexpected that we should not have taken *Myotis lucifugus altipetens* on Mount Whitney, a species whose normal range includes high altitudes.



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## BISON REMAINS FROM NEW ENGLAND

BY GLOVER M. ALLEN

As long ago as 1849, Sir Charles Lyell published the discovery of supposed bison teeth from a bank of glacial clay at Gardiner, Maine. In his book recounting his second visit to the United States, Lyell says (Second visit to the United States, 1849, vol. 1, pp. 43, 44) that the teeth were identified as those of bison by Sir Richard Owen, and that they had been found in association with the shells of marine mollusks identical with recent species. Three of the teeth eventually passed from their original owner, a Mrs. Frederic Allen, to the Bowdoin College Museum, and one was given to the Boston Society of Natural History, in whose possession it still remains. In his memoir on the American bison Dr. J. A. Allen reviews at some length the history of these teeth and shows (Mem. Mus. Comp. Zool., 1876, vol. 4, no. 10, p. 88-91) that Lyell had not himself seen the specimens in place, that their exact position in the clay bank was doubtful, and that Professor Owen disclaimed all responsibility for their identification. After a minute comparison, Doctor Allen was unable to distinguish them in any way from those of the domestic ox, to which he therefore referred them. There seems no reason to question this determination and it appears likely that the teeth had reached their position in the clay bank in some secondary way.

There is thus at the present time no proof that the bison ever occurred within the present limits of New England. Moreover the careful examination of accounts by early travellers as reviewed in Doctor Allen's memoir, indicates that within historic times and probably for a long period anterior to the coming of white men, the bison ranged no farther east than the present west-central Pennsylvania and the southeastern end of Lake Erie in what is now the extreme western corner of New York State.

It is therefore of interest to record the discovery of a fragment of the maxilla with two milk teeth of a bison at Orleans, on Cape Cod, Massachusetts. It is exceedingly fortunate that this discovery was made by a professional geologist, Dr. A. W. Grabau, whose manuscript note made at the time, now some twenty years ago, accompanies the specimen. From this it appears that the specimen was discovered wholly embedded in till about halfway up on a section of a glacial moraine, situated on Town Cove, and about seventy or eighty feet high. The moraine consisted of "till with boulders" much rain worn." Associated with the specimen in the till were many fragments of the marine mollusk *Venus*. Doctor Grabau has presented the specimen to the Boston Society of Natural History in whose collection it has since remained. It was brought to my notice during a recent revision of the Society's Pleistocene fossils and was still largely embedded in glacial sand. On carefully cleaning this away, the teeth were seen to be the second and third milk molars ( $dp^3$ ,  $dp^4$ ) of the left side, quite unworn and perfectly preserved, while fragments of an unerupted first permanent molar were also disclosed.

The manner of its occurrence suggests that the bison calf from which the fragment came had either met its end while wandering on the moraine during the formation process or more likely had lived during a previous interglacial stage and its scattered bones had been scraped up by a succeeding glacier during the time of the last or Wisconsin ice-sheet. That the teeth are wholly unbroken indicates that they suffered little from rolling or crushing. Presumably, the animal from which they came must have lived in the so-called Peorian interglacial stage just preceding the last advance of the ice-sheet.

From extensive researches on the mammals of the North American Pleistocene, Dr. O. P. Hay (Smithson. Misc. Coll., 1912, vol. 59, no. 20, p. 13) concludes that of the several species of *Bison* known to have existed in America, all "except *Bison bison* had become extinct before the Wisconsin ice-sheet had retired from its southernmost limit." In view of this conclusion and of the precise agreement of the specimen here recorded, with the corresponding teeth of *Bison bison*, I have referred it to the latter species. The occurrence of a bison in eastern Massachusetts in the latter Pleistocene times not only indicates a former range much farther to the eastward of its known limits within the historic period, but presupposes as well a certain amount of open grasslands. It was perchance an inhabitant of the ancient coastal-plain area, relics of whose fauna and flora are still preserved in isolated colonies along the New England and adjacent coasts.



Since the identification of this important specimen rests solely on the second and third upper milk molars, it may be well to point out some of the details of structure that distinguish these teeth in *Bison bison* from the corresponding teeth of the domestic ox, *Bos taurus*, for at first sight the teeth of the two species are very similar in general appearance. The second milk molar ( $dp^2$ ), on account of its more complicated structure, is of greater diagnostic value than either of the others. It is (1) slightly longer than in the domestic calf in four out of five specimens examined. (2) At the anterior outer corner there are at the summit of the crown, two very short crests embracing a shallow depression

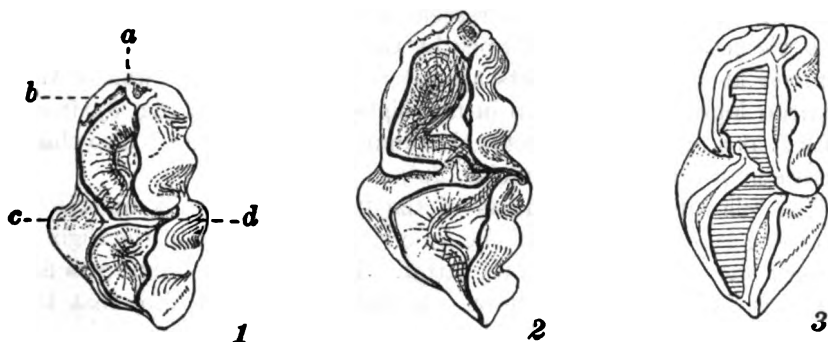


FIG. 1. DOMESTIC CALF, *Bos taurus*

Second upper milk molar ( $dp^2$ ) of left side, crown view (M. C. Z. 86)

FIG. 2. AMERICAN BISON, *Bison bison*

The same tooth of the Cape Cod specimen, crown view

FIG. 3. AMERICAN BISON, *Bison bison*

Same tooth, slightly worn, in a specimen from Kansas (M. C. Z. 90)

(fig. 1, *a*) in the domestic calf, whereas in the bison (fig. 2) these crests are much more prominent and are separated by a deeper cleft. Both species exhibit variation in the formation of these cusplets. In one domestic calf (M.C.Z. 86) they are practically confluent, without a sign of the dividing cleft; in another the cleft is a mere pit. In *Bison bison* on the contrary they are much better developed and in a slightly worn milk tooth (fig. 3) may even appear as two small lobes. (3) In the domestic calf the antero-internal cingulum cusp (fig. 1, *b*) is much better developed than in the calf bison, forming a narrow and evenly ascending ridge from the base of the tooth to the summit of the crown,

where it fuses with the inner of the two cusplets just described. In the calf bison on the contrary, its inception is much more abrupt from well up on the front side of the tooth and it is usually separated by a deep cleft from the external cusplets. In one specimen (M.C.Z. 112) it is so reduced as to be practically lacking but is represented by two or three minute denticles. (4) A fourth point of distinction is that while in the domestic calf the summit of the anterior crescent is rather evenly confluent with that of the posterior (fig. 1, c) in the calf bison the two crescents are usually separated by a distinct notch which in the slightly worn tooth (fig. 3) becomes less evident. Finally (5) the anterior horn of the posterior crescent, when unworn, is seen to extend into the peak of the angle formed by the two external lophs (fig. 1, d) whereas in the bison it abuts against the posterior inner wall of the anterior loph, and, as shown in the slightly worn tooth (fig. 3), fuses with it at a short distance below the summit. This feature is also characteristic of the third milk molar ( $dp^4$ ).

The following measurements of the two posterior milk molars in domestic calves and calves of the American bison bring out the slightly greater size of these teeth in the latter. The Cape Cod bison teeth are the first listed among the bison. It should be added also, that the teeth of bison no. 112 of the table, though as small as those of a domestic calf, in other respects show the characteristic form of the bison teeth to an extreme degree.

*Milk teeth of Bos taurus*

	COMBINED LENGTH OF CROWNS $dp^3$ -4	CROWN OF $dp^3$	CROWN OF $dp^4$
	mm.		
M. C. Z. 85 .....	50	26	27
M. C. Z. 86 .....	50	26	27
M. C. Z. 1954.....	51	26.5	28
M. C. Z. 9406.....	50	26	27

*Milk teeth of Bison bison*

B. S. N. H.....	53.5	28.5	28.5
M. C. Z. 89 .....	53	28.5	29
M. C. Z. 90 .....	52.6	27.7	27.6
M. C. Z. 112 .....	50.5	26	27.2
M. C. Z. 1711.....	52.5	28.2	29

Acknowledgments are due the Museum of Comparative Zoölogy for permission to study and record the excellent series of skulls noted above.

## AN INSULAR RACE OF COTTON RAT FROM THE FLORIDA KEYS

BY GLOVER M. ALLEN

In April, 1920, Mr. Winthrop Sprague Brooks collected two adult cotton rats (*Sigmodon*) on Big Pine Key, Florida, which are so different from those of the neighboring mainland, that they seem worthy of recognition as representatives of a distinct island race. Through the generosity of Dr. Thomas Barbour, the specimens are in the collection of the Museum of Comparative Zoölogy to the authorities of which I am indebted for the privilege of studying them.

Big Pine Key is one of a group of small islands lying some thirty-five miles southwest of Cape Sable, the nearest point on the mainland of Florida. A chain of larger and smaller islands trends northeast from Big Pine to Key Largo and forms the eastward margin of the Bay of Florida. The other islands of the chain continue westward to the Dry Tortugas. These southern keys have no doubt been separated from the peninsula itself for a long period.

Due to the investigations of Messrs. F. M. Chapman and Outram Bangs, the cotton rat of the subtropical tip of the Florida peninsula has long been recognized as a well-marked geographical race,—*Sigmodon hispidus spadicipygus*,—readily distinguishable from the larger and darker races to the north,—*S. h. littoralis*, covering most of peninsular Florida, and *S. h. hispidus* of Georgia and the southeastern states. The new race needs comparison with the first-named only. It may be known as

*Sigmodon hispidus exsputus*<sup>1</sup> subsp. nov.

*Type*, adult male, skin and skull, 18,100 Mus. Comp. Zoölogy, from Big Pine Key, of the southern Florida Keys, collected April 16, 1920, by Winthrop S. Brooks.

*General characters*.—Small, about the size of *S. h. spadicipygus* but with a proportionally longer tail; at once distinguishable from the latter race by the general pale ochraceous tone of the dorsal surfaces of head and body, with slaty rather than blackish bases to the hairs, and the clearer white of the belly with the bases of the hairs less prominent and of a paler slaty gray.

*Description*.—General color of the dorsal surfaces pale "ochraceous buff," clearest along the sides of the cheeks and body, becoming slightly deeper on the rump. The long overlying hairs of the pelage on the lower half of the back are whitish tipped instead of black throughout as in the mainland form. The concealed bases of the hairs are slaty instead of blackish, and lack the indistinct brownish cast of *spadicipygus*. Belly nearly clear white, the color rather sharply marked off at the sides, the pale slaty bases of the hairs showing through but little, in contrast to the mainland form in which the transition from the color of the back to that of the belly is less sharp and the belly much tinged with brownish and slaty where the bases of the hairs show through. Fore feet above like the sides; the hind feet dusky with a sprinkling of dull-whitish hairs. Tail dusky, with short sparse hairs which are blackish above, faintly whitish below.

The skull is essentially as in *S. h. spadicipygus*, but a very little slenderer.

*Measurements*.—The collector's field record gives the following: total length 269 mm., tail 117, hind foot 38.5, ear 18.5. The skull measures: greatest length 36.5 mm., basal length 32, palatal length 28.5, nasals 15, upper tooth row 6, lower tooth row 6, zygomatic width 20.5, mastoid width 15.

*Remarks*.—In a series of twenty excellent skins from Cape Sable and Flamingo, collected in late March and early April and representing *spadicipygus*, there is but one (Bangs Coll. 4490 from Flamingo) that closely resembles the island race in its color. It is at once distinguishable, however, by its slightly brownish or rusty tint especially on the lower back, by the blacker bases of the hairs, and by its much shorter tail. In eighteen specimens of *S. h. spadicipygus* the collector's field measurements indicate that the tail averages 37 per cent (extremes 35 to 41) of the total length, whereas in the two island specimens it is much longer, 45 per cent in each, a difference at once obvious to the eye. Both specimens were shot by Mr. Brooks in the day time, while they were running actively about in the scrub.

<sup>1</sup> *exsputus*, cast out, banished, exiled.



## FOSSIL CETACEANS FROM THE FLORIDA PHOSPHATE BEDS

BY GLOVER M. ALLEN

[Plates 9-12]

The occurrence of fossil cetaceans in Florida was briefly made known by Leidy, who, in 1889, recorded "half a dozen vertebrae and several teeth of several Cetacea of the family of the Dolphins" from the Peace Creek deposits. Concerning these remains, however, he makes no comment beyond the fact that they were "undetermined." More recently, in the commercial development of the phosphate beds, particularly in Polk County, additional fragments have come to light. Three of these are figured with brief mention, by Sellards (1915, p. 102-105) in the Seventh Annual Report of the Florida Geological Survey, but no attempt has been made to identify the species which they represent. Through the kind offices of Mr. Anton Schneider, lately Superintendent of the Amalgamated Phosphate Company, and through the interest of Vice-President F. F. Ward of the International Agricultural Corporation with works at Mulberry, the Museum of Comparative Zoölogy has recently acquired a few additional remains of fossil Cetacea from Polk County, and these, together with several fragments generously loaned by the Florida Geological Survey, form the basis of this paper.

### GEOLOGICAL OCCURRENCE

All the specimens come from what are known as the "land-pebble phosphate deposits," which, according to current geological opinion (Sellards, 1915, p. 58) constitute a pebble conglomerate, accumulated under marine or estuarine conditions, probably during late Miocene or early Pliocene time. This conglomerate forms the basal member of the "Bone-Valley formation," and is derived chiefly from an older phosphatic marl of Upper Oligocene age, from which have probably been redeposited the teeth of sharks and rays, casts of invertebrates, and silicified corals that occur with the broken but unworn bones of later-deposited cetaceans and crocodilians. It is believed that this area was exposed as a land surface during most, if not all of the Miocene, at the close of which it was again submerged, thereby allowing the accumulation of the conglomerate together with the remains of aquatic vertebrates of the period, in what must have been a relatively shallow sea.

The cetacean remains consist of fragments of the skull or vertebræ, and though for the most part badly broken, seem to have suffered as much from rough handling during extraction as from actual erosion, since they are chiefly such pieces as chanced to have been rescued in the course of mining the phosphate. Exact data as to the original relations of the specimens in the deposit are therefore unobtainable.

#### SPECIES REPRESENTED

At least three species of cetaceans, pertaining to as many genera, are represented by the material in hand. Two of these are dolphins of the slender-beaked type common in Miocene deposits of Europe, and related to the existing Iniidæ of estuarine and fluviatile habitat. Of these, one seems referable to the genus *Schizodelphis*, first recognized as occurring in America by True (1908); the other is a related genus for which a new name is proposed. It is peculiar in that the lower tooth rows close, proximally at least, *within* the upper, instead of interlocking. What seems to be a species of the same genus is present as well in Miocene formations of Europe, though the Florida species is more progressive than the European, and appears to represent the culmination of its line of evolution. The third species falls in the *Physeteridæ* or sperm-whale family. It is a whale of medium size, apparently congeneric with a species—*Diaphorocetus poucheti*—described from the Miocene of Patagonia. Like that species, it differs from existing members of this family through the possession of a rostrum rather narrow basally and provided with fully functional teeth in the upper as well as in the lower jaw.

An account of these fragments follows.

#### INIIDÆ—RIVER DOLPHINS

##### *Schizodelphis depressus* sp. nov.

Plate 9, fig. 1-5

1869. ? *Priscodelphinus grandævus* LEIDY, Journ. Acad. Nat. Sci., Phila., ser. 2, vol. 7, p. 434 (in part).  
 1904. ? *Rhabdosteus latiradix* CASE, Md. Geol. Surv., Miocene, p. 24 (in part), pl. 15, fig. 1 (not of Cope).  
 1908. ? *Priscodelphinus* sp.? TRUE, Proc. Acad. Nat. Sci., Phila., p. 28, fig. 1-3.

*Type*.—A fragment of the beak, 828 Fla. Geol. Surv., about 283 mm. in length, broken off in advance of the vomer; found five miles south of Bartow, Florida.

*General characters*.—A long-beaked dolphin of the *Schizodelphis* type, but

differing conspicuously from *S. sulcatus* in the flattening of the rostrum anteriorly and from *S. crassangulum* in the wider spacing and apparently greater size of the teeth. A shallow, broadly V-shaped groove occupies the midline of the palate and gradually fades out toward the tip of the beak. From the edge of this groove the plane of the maxilla slopes gently upward and outward to the strongly rounded lateral border, but near the tip of the beak the palate becomes nearly flat. The alveoli are large, the more proximal the smaller and separated by an interval less than the length of a single alveolus. The more anterior sockets are larger and farther apart, being separated by an interval nearly  $1\frac{1}{2}$  the length of a single alveolus. The alveoli themselves are nearly oval in outline, the more proximal directed slightly outward and forward, but the more distal with their long axes nearly parallel to the tooth rows.

*Description.*—This species is represented in the collection of the Florida Geological Survey by two fragments of the rostrum. The larger, here made the type of the species, is a section broken from slightly in advance of the palatal portion of the vomer. Its length is 283 mm., its breadth at base 48 mm., tapering to 37 mm. wide at the broken distal end. Its left basal end just includes the beginning of the deep longitudinal groove separating maxillary and intermaxillary. The combined intermaxillaries are at this point high (13 mm. above the groove) and broad (32 mm.) but become depressed and flattened forward, though losing little of their width. Though the right intermaxillary is very slightly the narrower, there is no marked asymmetry.

The large alveoli are nearly oval in outline and shallow. The first six or seven at the proximal end of the fragment are smaller and closer together than those succeeding and have their long axes turned slightly outward. The proximal four of the right side are smaller and closer together than those corresponding on the left side, and are included within a space of 31 mm. The separate alveoli average 6 by 3.5 mm., and are about 2 mm. apart. Beyond this point they are larger and of nearly uniform size, about 7.5 by 4.5 mm., elliptical in outline with their long axes parallel to the tooth row. The interspaces gradually increase to about 10 mm. at the anterior end of the fragment.

The second specimen (5885 Fla. Geol. Surv.) referred to this species, came from much nearer the tip of the beak. It is 172 mm. long, 28 mm. wide at the proximal and 25 mm. wide at the distal end. Its dorsal portion is largely formed by the intermaxillæ, which are nearly flat above, and have fused medially so that no trace of the original suture is evident. The combined width of the intermaxillæ is 18 mm. proximally and 13.5 mm. distally. This portion of the beak is strongly flattened dorsoventrally so that the palatal surface is nearly parallel to that of the intermaxillaries. Laterally, however, the maxillaries are slightly bevelled outward from the palate, and the tooth sockets are situated along this narrow bevelled area so that they are visible in side view. The comparatively large size, nearly elliptical outline, and wide spacing of these shallow sockets are maintained very uniformly to the anterior end of the specimen, which must have included all but a very small portion of the tip of the beak. The groove marking the line between maxillaries and intermaxillaries becomes much shallower on the right-hand side than on the left, though in the larger fragment this disparity was not noticeable.



Possibly referable to this species is the centrum of a lumbar vertebra (15786 M.C.Z.) from Mulberry. It has lost the lateral processes and the neural spine, but shows, still intact, a median dorsal ridge running nearly the entire length of the vertebra. This is low and laterally compressed, with rounded summit, and about 4 mm. high at the middle point, where on each side are one or two small pits in the groove at its base. Dal Piaz (1905) mentions a similar ridge on the vertebrae of *Schizodelphis sulcatus* and it is visible in anterior view in several of the vertebrae he figures. The centrum itself is long as compared with that of most modern dolphins, some 57 mm., lacking the posterior epiphysis. The anterior face is subcircular in outline, with a vertical diameter of 32 mm., and has a small linear depression at its center. The posterior outline is subtriangular due to the flattening of the ventral contour.

*Remarks.*—Of these three specimens, the larger rostral fragment recalls very strongly a similar piece from the Miocene of Shiloh, New Jersey, referred by Leidy (1869) to his *Priscodelphinus grandaevus* and figured as such by Case (1904, pl. 15, fig. 1), and again as *Priscodelphinus* sp.? by True (1908 a, p. 28, fig. 1-3). Indeed, the Florida specimen seems to offer little in itself to distinguish it from the New Jersey fragment, except that its intermaxillae in side view are possibly higher in proportion to the maxillaries. All the fragments may therefore be provisionally considered as representing the same species. The selection of a name for them, however, is not an easy matter. For, though Leidy referred the Shiloh specimen to his *Priscodelphinus grandaevus*, the latter was really based on two caudal vertebrae of an immature animal, so that the association of the rostral fragment with these is purely assumptive, though all the bones were from the same locality. Furthermore, it is uncertain whether the caudal vertebrae on which the species *grandaevus* was founded, are congeneric with the dorsal vertebra which Leidy made the type of the genus *Priscodelphinus*. Moreover, there appears to be some ground for believing (True, 1908) that this genus is itself identical with *Schizodelphis*. If this identity could be shown through the discovery of an associated skeleton, the former name would have priority, and the latter would then become a synonym of it. But awaiting further light on the matter it seems best to retain the two generic names as originally applied. True (1908 a) in referring again to Leidy's specimen refrains from giving it a specific name, but the occurrence of what seems to be the same dolphin in the Florida deposits makes it advisable to give it a distinctive title for convenient use, even though the fragments at hand are insufficient for a complete diagnosis.

**Pomatodelphis gen. nov.**

**Diagnosis.**—Long-beaked dolphins resembling *Schizodelphis* in general form of the skull except that the rostrum has a convex expansion of the maxillary outline at the proximal end of the tooth rows; combined width of lower jaws narrower than the upper so that the lower tooth rows close *inside* the upper (like the lid of a pot—*πῶμα*); teeth of lower jaw directed upward into the maxillary, where the tips of the more posterior are received in shallow pits, instead of being, as in *Schizodelphis*, directed outward and interlocking with the maxillary teeth outside the tooth rows.

**Genotype.**—*Pomatodelphis inaequalis* sp. nov.

**Pomatodelphis inaequalis sp. nov.**

## Plates 10, 11

**Type.**—A fragment, 15750 M.C.Z., from the base of the right maxilla, 114 mm. long, comprising one-half the breadth of the palate, from Brewster, Polk County, Florida. Gift of Amalgamated Phosphate Co., through Anton Schneider and Thomas Barbour.

**Description.**—The type fragment includes thirteen small and much compressed alveoli, of which the posteriormost are close together but the more anterior are much farther apart. All are round-edged and contract forward to a point; they are mere slits and probably did not support functional teeth. Internal and parallel to this row of thirteen alveoli is a series of some ten or eleven shallow pits made by the tips of the mandibular teeth, which closed perpendicularly against the maxilla inside the line of the upper tooth row. The palate itself is quite flat. The external border of the maxilla is abruptly and strongly rounded.

Three specimens in the collection of the Florida Geological Survey supplement the type most acceptably. They comprise a cranium, which though in several fragments wants little more than the terminal part of the beak and the middle portion of the brain case; a second imperfect rostrum, comprising most of the base of the beak; and a third fragment from near the tip of another rostrum. From these a fairly clear idea of the cranium may be gained.

The summit of the cranium instead of culminating in the elevated nasals, as in modern Delphinidæ, is formed by a transverse crest along the line of union of the frontals and the supraoccipital. The latter seems to have been nearly perpendicular to the long axis of the cranium, so that the back of the skull is rather squarely truncate. The interparietal appears medially at the apex of the skull, as a narrow transverse bone wedged in between the large supraoccipital and the frontals. It is about 40 mm. from side to side and 6 mm. in antero-posterior extent in the midline, tapering to a point at each side. In front of it appears a slightly depressed rectangular field formed by the frontals, some 25 mm. square against the anterior side of which about the remains of the nasals.

The blowholes are embraced by the proximal ascending portions of the intermaxillæ, the tips of which are here contracted to a blunt point in contact with the middle of the frontal on either side, some 10 mm. in advance of the transverse occipito-frontal ridge. A large foramen opens under the posterior margin of

each intermaxillary. It is continued forward and inward beneath this bone and is probably the opening of a perforation of the maxillary quite obvious in most modern dolphins, but here covered by the expanded intermaxillary. The backward extension of the maxillary almost completely covers the outer part of the frontal, at least on the right-hand side, and thus heightens the appearance of fore-and-aft compression of the brain case.

The intermaxillaries are broad, thin and nearly plane posteriorly, but quickly become narrower opposite the front of the blowholes, and then slightly expand, their surfaces sloping inward toward the triangular area in front of the nares, before continuing forward on to the beak. A very shallow groove runs from near the outermost part of this proximal expansion, forward and inward, becoming lost at the inner sloping margin of the triangular area. A similar groove is present in *Schizodelphis*. At this level commences a marked asymmetry. The right intermaxillary suddenly narrows while the left broadens out for a short distance and becomes much thinner at its outer edge. Forward from this point both intermaxillaries become raised and thickened, extending as two parallel flat-topped ridges, closely appressed medially, to the broken extremity of the beak. From the flattened maxillaries they are sharply marked off by a deep longitudinal groove along the line of contact. The right intermaxillary is markedly the smaller and its delimiting groove the shallower.

A fragment (2343 Fla. Geol. Surv.) from very near the tip of a rostrum, and apparently representing the same species, shows that the two intermaxillaries fuse medially toward their distal extremity.

The base of the rostrum is peculiar in outline. Opposite the anterior tips of the pterygoids it becomes strongly compressed from side to side, with gently concave margins as seen from below; then it expands widely, reaching the greatest convexity opposite the base of the visible part of the vomer, beyond which it tapers forward to form the beak. The tooth rows begin just in advance of the widest expansion. There is thus a distinct neck formed at the base of the rostrum succeeded by a convex expansion, very different from the gradual and even taper from the maxillary notches forward, seen in *Schizodelphis*. A somewhat similar outline is seen, however, in the newly discovered living genus, *Lipotes* (Miller, 1918). In ventral aspect, the entire palate in advance of the vomer is quite flat with a shallow median V-shaped groove where the bevelled edges of the maxillaries meet. It thus differs markedly from *Schizodelphis sulcatus*, in which according to the figures of Dal Piaz (1903, p. 195) the maxillaries are strongly bevelled outward. At the base of the rostrum the pronounced asymmetry previously noted in the dorsal aspect is again evident. For while on the left-hand side of the beak the proximal part of the maxilla widely expands, carrying with it the tooth row, on the right-hand side the expansion is less marked, and the palatal surface is much more nearly in a vertical plane so that the tooth row is placed much higher on the cheek. The alveoli are also smaller and closer together on the right-hand side in this region.

The vomer appears in advance of the palatals as a narrow lozenge-shaped slip about 100 mm. long by 8 wide in the broadest place. Fortunately enough remains of the posterior end of the vomer to fix the shape and position of the blowholes. That of the right-hand side is much the smaller and opens well to the right of the median axis of the skull, while that of the left side is so much larger

and has so encroached on its neighbor that it has come to occupy a median position. This asymmetry seems not to be found in *Schizodelphis* (the apparent asymmetry shown in Dal Piaz's figures, 1903, pl. 1, is obviously due to distortion of the fossil). Although an accurate measurement is not possible, the left blowhole seems to have been at least 20 mm. in antero-posterior diameter, the right-hand blowhole about 14 mm.

The alveoli of the upper jaw, particularly those of the right-hand side, are more or less slit-like, rounded posteriorly and contracted to a point forward. Their edges instead of being sharply defined, are rounded, with a healed-over appearance, and it seems probable that if teeth were present at all in the upper jaw they must have been very small, non-functional, and with bases buried in the gums instead of fitting into sockets. The posterior alveoli of the left side are apparently a little larger at the base of the rostrum and may have held small teeth.

Most remarkable is the series of depressions seen on the palate *internal* to each tooth row, in at least the basal portion of the beak. These are obviously made by the tips of the *mandibular* teeth, and may or may not come opposite the alveoli of the upper jaw. Their presence indicates that the teeth of the mandible closed vertically *into the maxilla*, that they were larger than the maxillary teeth if any existed, and that the width across the lower tooth rows was less than that across the upper alveolar series. This allowed the upper jaw to close over the lower jaw like the lid of a pot. A certain parallelism may be seen here with the sperm whale, in which the lower jaws are in like manner narrower than the width between the upper alveolar lines, the rostrum has at the same time become expanded, and the upper teeth have become functionless. No doubt this modification is a result of a change from an actively fish-capturing habit to one requiring less seizing and holding as in the squid-eating (teuthophagous) cetaceans generally.

In the fragment, from the right side near the base of the rostrum, there are 6 alveoli in a space of 33 mm., with intervals of from 2 to 8 or 9 mm. between them, and 6 depressions formed by the mandibular teeth in a space of 55 mm. In the larger rostral fragment (5834 Fla. Geol. Surv.) there are:

<i>Right side</i>	6 alveoli in 32 mm. near base
	6 alveoli in 56 mm. near end
	6 depressions in 50 mm. about halfway
<i>Left side</i>	6 alveoli in 53 mm. near base
	6 alveoli in 68 mm. about halfway
	6 depressions in 69 mm. about halfway

In the small fragment from the tip of the beak (2343 Fla. Geol. Surv.) there appear to be 6 alveoli in about 35 mm.

The posterior end of the cranium (5834 Fla. Geol. Surv.) which has served for the greater part of the above description, is considerably broken, but enough fragments remain to afford a good idea of its appearance. The condyles are large and prominent yet quite without the distinct neck shown in skulls of *Schizodelphis sulcatus* (Abel, 1899; Dal Piaz, 1903). That of the right side is the larger. The lack of a distinct neck to the cranial condyles and their large smooth surface tending to merge with that of the occiput show a progressive condition considerably ahead of the latter genus. The greater fore-and-aft compression is further shown by the notably shorter distance both relatively and absolutely between

the glenoid cavity of the jaw and the cranial condyles. The occipital crests arise as sharp ridges from the upper side of the squamosal processes, and meet in a transverse ridge at the summit of the skull. Posteriorly the squamosal and adjacent surfaces are irregularly pitted or roughened for muscle attachments, quite unlike the smooth surfaces in skulls of modern dolphins. The glenoid cavity for the articulation of the jaw is relatively small, a primitive feature, and that of the right side is the smaller. A broad groove bounds the lower inner margin of the articulating surface.

The specimen affords the following complete measurements:

	mm.
Extreme width of skull across squamosal processes.....	199.0
Width of braincase across bases of same.....	143.0
Width across occipital condyles.....	91.5
Right condyle, greatest vertical diameter.....	52.0
Right condyle, greatest transverse diameter.....	32.0
Left condyle, greatest vertical diameter.....	49.0
Left condyle, greatest transverse diameter.....	30.5
Foramen magnum, greatest vertical diameter.....	27.0
Foramen magnum, greatest transverse diameter.....	40.0
Lip of foramen magnum to basisphenoid suture.....	81.0

*Remarks.*—In establishing this new genus and species a careful review of the literature has been made in order to ascertain if other specimens, congeneric with it, have been described. It is obvious that species and genera based on other parts of the skeleton than the cranium can at present afford no sure points of comparison. There are, however, two specimens from the Miocene of Europe, that appear to be referable to the new genus. The first of these is a fragment of the right maxilla first mentioned and figured by Cuvier (Rech. sur les Oss. Foss., 1823, ed. 2, vol. 5, pt. 1, p. 317, pl. 23, fig. 38) as belonging to a "dauphin dont une portion de mâchoire supérieure a été trouvée dans le calcaire grossier du département de l'Orne." In the fourth edition of the same work (1836) the specimen is said to be from the "département de Maine-et-Loire." Whichever locality may be correct, it is fairly certain that the horizon is Miocene, probably middle Miocene. The specimen is next referred to by Holl (1829) in a work rarely cited, Handbuch der Petrefactenkunde. Here it is listed as "*Delphinus stenorhynchus* Cuv." with brief mention and reference to Cuvier's work. The latter author, however, though having observed in his original account, that the species was unlike any other hitherto described, gave it no name either in this or in the later editions of the Ossemens Fossiles, and apparently quite overlooked or ignored Holl's name. Thus Holl, though citing Cuvier as authority, seems to have been himself the actual author. Later writers, including Brandt,

have attributed the name to Keferstein (1834), who, however, cites it without reference as a synonym of *D. longirostris*, a name applied to a living species of *Prodelphinus* by Gray in 1828, and to a species of *Delphinus* by Dussumier in 1829. In 1846, Laurillard, evidently supposing that the fossil required a new specific designation formally bestowed the name *Delphinus renovi* upon it after the original discoverer, and it is so figured in three views by Van Beneden and Gervais in the *Ostéographie*. Finally, Longhi in 1898, referred it to the genus *Champsodelphis*. As may be gathered from the figure (Text-fig. 1), it agrees with the Florida species in the strongly convex outline of the base of the maxilla. In both, the proximal end of the tooth row makes

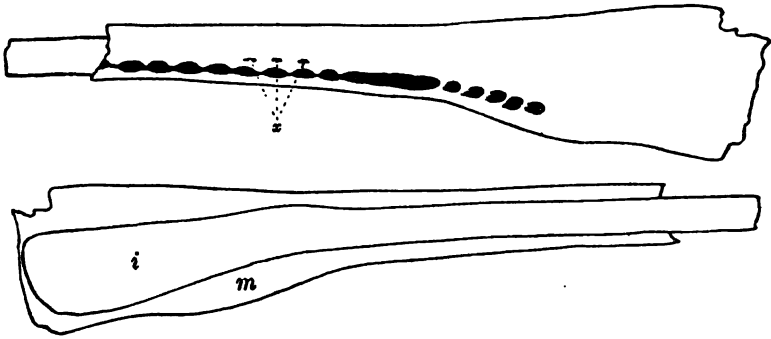


FIG. 1. *Pomatodelphis stenorhynchus* (HOLL)

Dorsal (lower fig.) and ventral (upper fig.) outlines of the type specimen. France, Département de l'Orne. After Van Beneden and Gervais, *Ostéographie*, pl. 57, fig. 9. *i*, intermaxillary; *m*, maxillary; *x*, depressions for reception of mandibular teeth.

an outward bend at this point, but in the French specimen the row of alveoli ends about opposite the summit of the convexity, whereas in the Florida species it ends in advance of this point. Moreover, the alveoli themselves seem much larger in the former and doubtless supported functional teeth. A more important point is indicated in the figure by the presence of three shallow depressions near the middle of the length, internal to the alveolar row, for the reception of the points of the corresponding mandibular teeth. This detail, perhaps not fully brought out by the artist, shows that the lower tooth row closed *within* the upper, at least proximally, and, taken in connection with the similarity of the maxillary outline, seems to indicate at least a generic affinity with *Pomatodelphis*.

It seems almost certain that Paquier's *Schizodelphis depereti* is the same species as that represented by Cuvier's fragment. The type specimen comprises the cranium forward of the blowholes and most of the lower jaw, but the rostrum has been broken off somewhere near its middle. The excellent photographs of the specimen show the same convexity at the base of the maxillary, while the broken and projecting end of the lower jaw is obviously much narrower than the upper at the same point, as if it had closed *inside* the latter, a point further indicated by the fact that the small lower tooth preserved is expressly stated to have its tip hidden in the upper maxillary. In both dorsal and ventral views, the right and the left sides show no marked asymmetry. Abel (1899) though admitting many discrepancies between this skull and that of *Schizodelphis sulcatus*, nevertheless dismisses it as representing probably the latter species. The locality of Paquier's specimen is southern France, "les carrières de Chamaret (Drôme)" in the Rhone valley. The formation is the "mollasse burdigalienne," considered to be lower Miocene. Assuming that Paquier's specimen represents the same species as Cuvier's from northern France, the synonymy will stand as follows:

**Pomatodelphis stenorhynchus (Holl)**

- 1823. Dauphin . . . . du département de l'Orne; G. CUVIER, Rech. sur les Ossements fossiles, ed. 2, vol. 5, pt. 1, p. 317, pl. 23, fig. 38 (see ed. 5, 1836, p. 168, pl. 224).
- 1829. *Delphinus stenorhynchus* HOLL, Handbuch d. Petrefactenkunde, part 1, p. 70.
- 1834. *Delphinus longirostris* oder *stenorhynchus* KEFERSTEIN, Die Naturgeschichte des Erdkörpers, vol. 2, p. 203 (not *D. longirostris* Gray, 1828; not Dussumier, 1829).
- 1841. *Delphinus longirostris* H. VON MEYER, Neues Jahrb. f. Mineral., 1841, p. 327.
- 1844. *Delphinus renovi* LAURILLARD, in D'Orbigny, Dict. Univ. d'Hist. Nat., vol. 4, p. 634, pl. fig. 38.
- 1873. *Delphinus renui* BRANDT, Mém. Acad. Imp. Sci. St. Pétersbourg, ser. 7, vol. 20, p. 247 (emendatio).
- 1894. *Schizodelphis depereti* PAQUIER, Mém. Soc. Géol. de France, vol. 4, no. 12, p. 7.
- 1898. *Champsodelphis renovi* LONGHI, Atti Soc. Veneto-Trent. Sci. Nat., Padova, ser. 2, vol. 3, p. 333.

Though referred to the same genus, there seem ample grounds for considering the French species distinct from the Florida one. The figures of the former, especially that of Cuvier representing the right maxillary, show the proximal alveoli large and somewhat closely

crowded, instead of small and well spaced. The intermaxillaries in profile do not curve upward so abruptly, their outline as seen from above is different, and there is no such marked asymmetry as shown in *P. inaequalis*. The latter in its greater specialization seems to be a more progressive species, as might perhaps be anticipated from its supposedly later geologic appearance (upper Miocene or lower Pliocene).

The peculiar vertical implantation of the mandibular teeth, and the fact that at least the more proximal close within the maxillary rows, suggest a possible relationship to *Platanista*, in which exactly these conditions occur at the base of the beak, although in other respects the latter genus shows far greater specialization, as in the greater compression from side to side, of the entire rostrum. The development of its characteristic maxillary crests seems of less systematic importance, for incipient crests are found in *Phocæna* on the intermaxillaries, and very large ones in *Hyperoodon* on the maxillary bones.

#### PHYSETERIDÆ—SPERM WHALES

##### *Diaphorocetus mediatlanticus* (Cope)

Plate 9, fig. 6; Plate 12

- 1895. *Paracetus mediatlanticus* COPE, Proc. Amer. Phil. Soc., vol. 34, p. 135.
- 1902. *Hypocetus mediatlanticus* HAY, Bull. U. S. Geol. Surv., no 179, p. 596;  
CASE, Md. Geol. Surv., Miocene, 1904, p. 30, pl. 17, figs. 6a, 6b.
- 1904. *Hypocetus atlanticus* CASE, Md. Geol. Surv., Miocene, expl. of plates, p. 9  
(errorim).
- 1898. *Diaphorocetus mediatlanticus* TROUESSART, Cat. Mamm., new. ed., p. 1053;  
3d ed., 1905, p. 772.

To this genus and species are referred a fragment of the lower jaw, including both rami, from the phosphate beds at Brewster, Polk County, and a second fragment comprising the occipital condyles, from Mulberry. Apparently pertaining to the same species is the beautiful specimen figured by Sellards (1915, p. 103, fig. 32), also found at Mulberry, consisting of the basal portion of the rostrum including both upper and lower jaws. Most unfortunately, this piece, which was for a time in the possession of the International Agricultural Corporation, has been disposed of and cannot be traced.

The genus *Hypocetus* was established by Lydekker in 1893, as a substitute for *Mesocetus* (preoccupied) of Moreno (1892), type *Mesocetus poucheti*, a medium-sized cetacean of the sperm-whale family,



with well developed, functional teeth in the upper as well as in the lower jaw. On a subsequent page of the same paper, Lydekker, evidently through inadvertence, calls the genus *Paracetus*, but *Hypocetus* has page priority. This paper, though bearing date 1893, was actually issued in April, 1894, and is, therefore, later than a paper by Ameghino dated February, 1894, in which the generic term *Diaphorocetus* is proposed for the same specimen and thus has priority (see Palmer, Index Gen. Mamm., 1904, p. 341). A further difficulty in the specific reference lies in the fact that it is not clear whether Cope's species *mediallanticus* really differs from Moreno's *poucheti*. The type of the latter is a fairly well preserved skull lacking the jaw, from Bahia Nueva, Chubut Territory, Patagonia, found in a formation which Ameghino believed to be of Eocene age, but which is now considered to be lower Miocene (True, 1910, p. 31). Cope's type of *mediallanticus* is a large fragment consisting of the base of the rostrum with the alveoli of the proximal seven or eight pairs of maxillary teeth, and parts of the intermaxillaries, vomer, and adjacent bones. It is from the St. Mary's formation at Drum Point, Maryland, now regarded (Cushman, 1920, table opp. p. 40) as of upper Miocene age. Cope attempts no comparison of his specimen with Moreno's *poucheti*, beyond the statement that the two are "not distantly related." From Case's figure of the type, however, it appears that the alveolar row extended back only to the level of the middle of the vomer, whereas, in Moreno's figure (1892, pl. 10) of *poucheti*, indications of alveoli seem to continue considerably posterior to the vomer. A slight difference in the outlines of the palatal bones is also seen, but how far these differences are individual rather than specific must await the discovery of additional specimens. It therefore seems best to retain Cope's name *mediallanticus* for the present and to refer the Florida fragments provisionally to it. A description of these follows.

(1) The finest specimen of all is the fragment of rostrum figured by Sellards (1915, p. 103, fig. 32), as the "side view of upper and lower jaw of another cetacean." It is shown at about one-half natural size and was 300 mm. long, comprising a portion of both jaws broken from slightly in advance of the symphysis. It obviously includes some of the posteriormost of the teeth. Its upper profile is nearly plane with a line parallel to it marking the suture between maxillary and intermaxillary. The ventral outline of the lower jaw shows the distinct angle at the beginning of the symphysis so characteristic of the sperm whales. Posteriorly from this angle the teeth of both jaws at once show a successive diminution in size, while in advance of it they are all of a nearly uniform size and

spacing. The opposing series of the two jaws interlock, with the points of the teeth directed outward, those of the more posterior slightly recurved. A longitudinal crack appears in the mandible, evidently due to crushing. The photograph shows very clearly that the teeth had distinct crowns, doubtless of enamel, which stand out dark and discolored in contrast to the white of the exposed roots. Eleven maxillary teeth are apparent in the figure and at least ten mandibular teeth (Plate 12, fig. 13).

(2) The second fragment is from Brewster, Polk County (15751 M.C.Z.), the gift of Dr. Thomas Barbour. It is a section, some 150 mm. long, of the conjoined mandibles beginning slightly in advance of the symphysis. At the posterior end the rami are separate for about 20 mm.; in front of this point they begin to contract slightly in width and are thoroughly fused together with the line of contact deeply impressed. Three complete alveoli with parts of two others are present in each ramus. The posteriormost on the right side is the smallest. It contains a root still in place and is separated by a narrow interval from the alveolus next in advance. The three succeeding alveoli are about of the same size with interspaces greater than those separating the alveoli of the left side. From this it results that the corresponding sockets of opposite sides are not in the same transverse plane, but alternate with the opposite interspaces. The lengths of these sockets and interspaces are:

	<i>Left ramus</i>	<i>Right ramus</i>
Proximal socket.....	—	18
First interspace.....	10	2
Second socket.....	22.5	20
Second interspace.....	9.5	12
Third socket.....	20	22
Third interspace.....	8	15
Fourth socket.....	20	20
Fourth interspace.....	15±	16±
Combined length of middle three sockets.....	78	90

A slight asymmetry is thus evident in the rami of opposite sides.

The two roots still in place are broken off at the level of the jaw and are nearly oval in section, with the longest transverse diameter turned outward and forward in the posteriormost but nearly parallel with the tooth row in the anteriormost tooth. In side view are seen several short and shallow depressions in the rami marking the exit of the mental nerves. About halfway up on the ramus a very shallow longitudinal groove is evident, beginning from the most proximal of these exits just in front of the symphysis.

(3) The third fragment referred to this species is a portion of the base of a skull from Mulberry, comprising the occipital condyles (15787 M.C.Z.). These are prominent and rounded, though but slightly marked off from the occipital surface by a raised border. Their greatest vertical diameter is very nearly at right angles to the transverse plane of the skull, and the greatest width is at about the middle point of their height. In measurements they are practically identical with those recorded by Moreno for *D. poucheti*.

## MEASUREMENTS OF 15787 M.C.Z.

	mm.
Greatest transverse width across both condyles.....	144
Greatest vertical diameter of right condyle.....	93+
Greatest vertical diameter of left condyle.....	100±
Greatest width of right condyle.....	57
Greatest width of left condyle.....	59
Distance between right and left condyles above.....	41
Distance between right and left condyles below.....	14
Foramen magnum, vertical diameter.....	63±
Foramen magnum, transverse diameter.....	45

It is possible that a cetacean vertebra from Brewster figured by Sellards (1915, p. 105, fig. 33) belonged to a whale of this same species.

## SUMMARY

It is evident that the three fossil cetaceans here noticed have much in common with species occurring elsewhere in Miocene formations. The first, *Schizodelphis depressus*, is closely allied to a species represented in the Miocene of Shiloh, New Jersey, if indeed it is not identical with it. The second, *Pomatodelphis inaequalis*, is referred to a new genus that apparently occurs as well in the lower and the middle Miocene of France, where, however, it is represented by a less specialized species. The implantation of the teeth suggests a possible relationship to *Platanista*, though it is considered one of the Iniidae. The third is closely related to a cetacean described from the lower Miocene of Patagonia and is believed to be identical with a species, *Diaphorocetus mediatlanticus*, discovered in the upper Miocene of Maryland. On the whole, therefore, the evidence of the cetacean remains points to a late Miocene age for these "pebble phosphate" deposits of Florida. The two species of Iniidae seem to represent the terminal members of a group now extinct, though related to the existing river dolphins. The one Physeteroid is a more primitive representative of a group that has survived to the present day, but whose living members, perhaps through a change from fish-eating to squid-eating habits, have lost the functional teeth of the upper jaw.

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## EXPLANATION OF PLATES

## PLATE 9

FIG. 1. *Schizodelphis depressus*, sp. nov. Palatal view of basal portion of beak, from near Barstow, Florida. Type, 828 Fla. Geol. Surv. × .39.

FIG. 2. Dorsal view of same.

FIG. 3. *S. depressus*, a fragment from near tip of beak. 5885 Fla. Geol. Surv. × .39.

FIG. 4. Dorsal view of same, showing fusion of intermaxillaries.

FIG. 5. Centrum of a lumbar vertebra referred to *S. depressus*, showing median ridge projecting into neural canal. Mulberry, Fla. 15786 M.C.Z. × .39.

FIG. 6. *Diaphorocetus mediantlanticus* (Cope). Cranial condyles, posterior view. Mulberry, Fla. 15787 M.C.Z. × .43.

## PLATE 10

FIG. 7. *Pomatodelphis inaequalis*, sp. et gen. nov. Portion of rostrum, palatal view, showing the asymmetry of structure, and the row of depressions for tips of mandibular teeth internal to the maxillary tooth row. Those of left side partly filled by plaster. *n, n*, the blowholes; *v*, vomer. 5834 Fla. Geol. Surv.  $\times .5$ .

FIG. 8. Dorsal view, showing the entire specimen.  $\times .44$ .

FIG. 9. *P. inaequalis*, a fragment from near tip of beak, dorsal view, showing fusion of intermaxillaries, and dorso-ventral flattening. 2343 Fla. Geol. Surv.  $\times .75$ .

## PLATE 11

FIG. 10. *Pomatodelphis inaequalis*, palatal view of fragment of right maxilla. The nine depressions for reception of mandibular teeth are indicated by dotted line to center of each. Brewster, Fla. Type. 15750 M. C. Z.  $\times .90$ .

FIG. 11. Same, dorsal view of summit of skull, showing (outlines dotted): frontals (*f*), bases of intermaxillaries (*i*) and maxillaries (*m*), interparietal (*ip*), and part of supraoccipital (*so*). 5834 Fla. Geol. Surv.  $\times .50$ .

FIG. 12. Same, posterior view of supraoccipital fragment (above), condyles, and squamosal processes of cranium. 5834 Fla. Geol. Surv.  $\times .50$ .

## PLATE 12

FIG. 13. *Diaphorocetus mediatlanticus* (Cope), base of rostrum in side view, showing teeth in both jaws. Found near Mulberry, Fla., but now lost. (Cut loaned by Fla. Geol. Surv.; see Sellards, 1915, p. 103).  $\times .50$ .

FIG. 14. Same, dorsal view of jaw fragment from just in advance of symphysis. Brewster, Polk Co., Fla. 15751 M.C.Z.  $\times .83$ .

*Cambridge, Massachusetts.*





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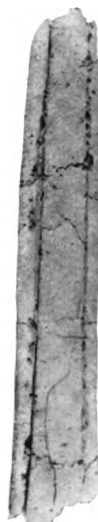
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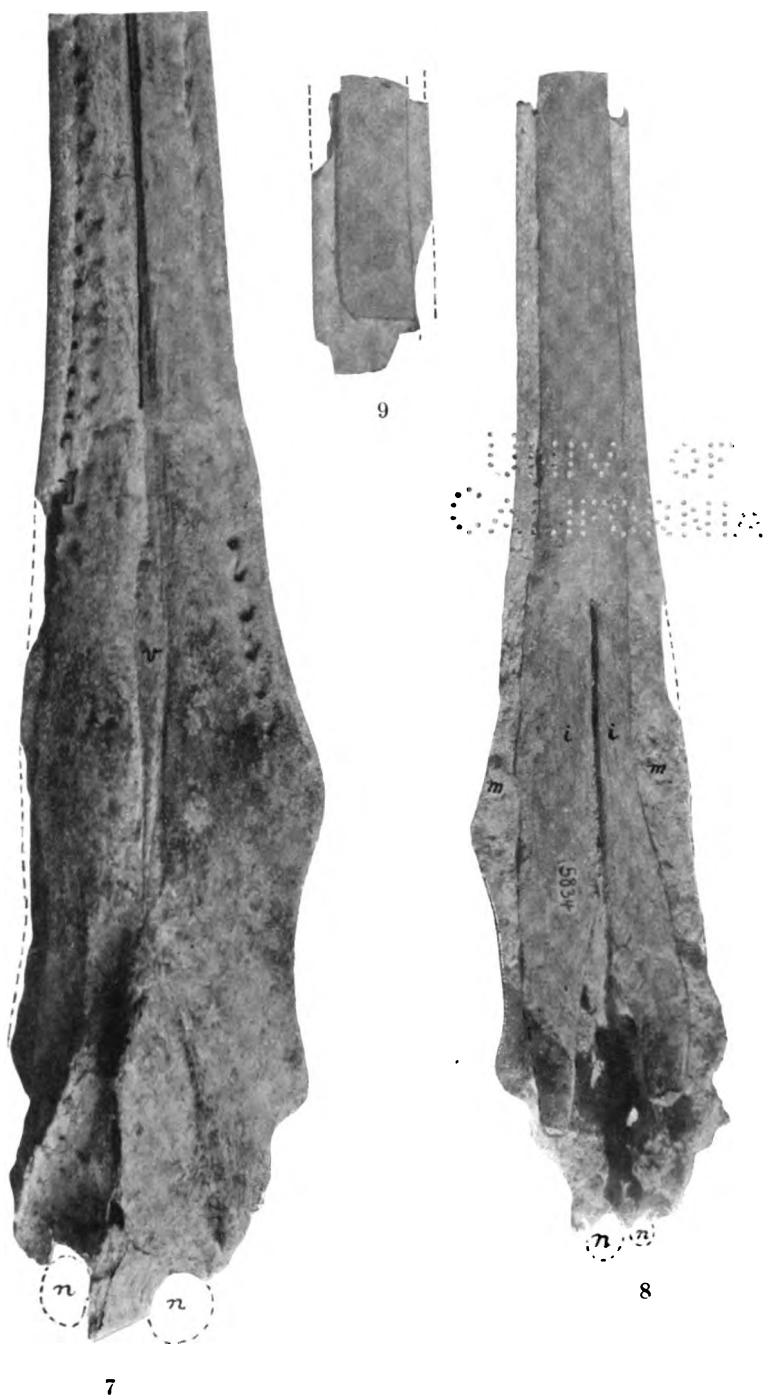


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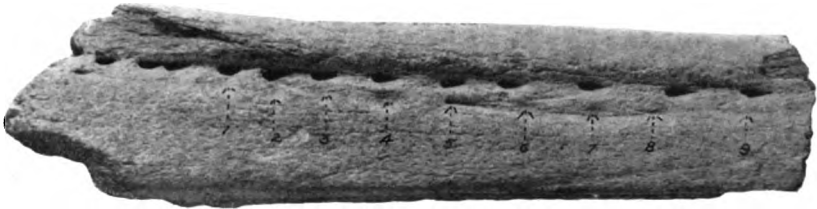
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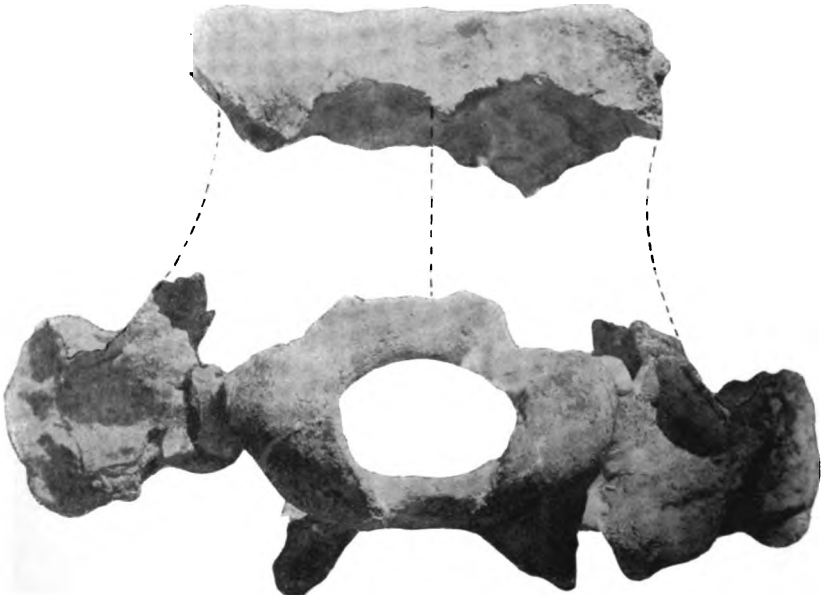


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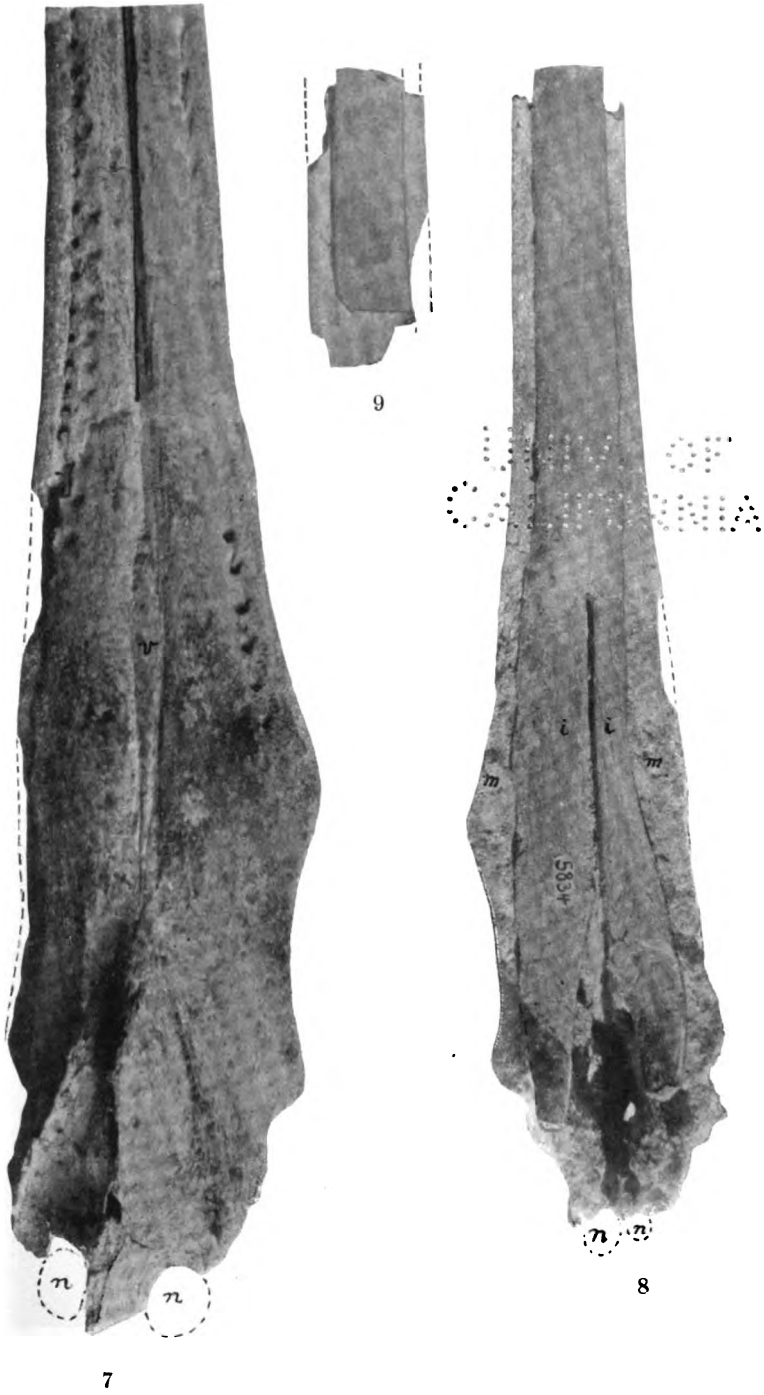
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# AMERICAN MUSEUM NOVITATES

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## NEW CHINESE BATS<sup>1</sup>

BY GLOVER M. ALLEN

Over five hundred bats have been thus far sent back by the Asiatic Expeditions under the leadership of Mr. Roy C. Andrews. These are chiefly from Fukien, Szechwan, southeastern Yunnan, and North China. The series of skins is well supplemented by specimens in alcohol, and in many cases wide-ranging species are represented by a number of skins from the coastal regions as well as by others from the higher or more inland provinces, so that an unusual opportunity is afforded for a comparison of the lowland and the upland members of a species. This is undoubtedly the largest single collection of bats yet obtained by any one expedition in China, and my thanks are due The American Museum of Natural History for the opportunity to study this important series. The following are recognized as new.

### Rhinolophidae

#### *Rhinolophus blythi calidus*, new subspecies

? *Rhinolophus cornutus pumilus* ANDERSEN, 1905, Proc. Zool. Soc. London, II, p. 127 (in part, as to specimen from Foo-chow).

TYPE.—Adult female, skin and skull, No. 44692, American Museum of Natural History, from Yenping, Fukien Province, China. Roy C. Andrews, collector. June 17, 1916.

DESCRIPTION.—Similar to *R. blythi szechwanus* Andersen, but much brighter, more cinnamon throughout. The bases of the hairs above are everywhere whitish, with a faint buffy tint, their tips dull cinnamon, near "sayal brown" of Ridgway (1912); below pale pinkish buff, the hairs becoming whitish near their bases.

MEASUREMENTS.—The skull is a very little larger than in *szechwanus*; its total length, occiput to front of canine, 16 mm.; palatal bridge, 1.8; maxillary tooththrow, 5.7; mandibular tooththrow, exclusive of incisors, 6.3. The forearm measures 38 mm.; tibia, 15; foot, 7.

This is a bright-colored lowland representative of *R. blythi* of India, and is very different in color from the series of smoky-gray specimens from Szechwan representing Andersen's *R. b. szechwanus*. The species was included as *Rhinolophus minor* in this author's preliminary revision of the small bats of the *lepidus* (= *pumillus*) group in 1905. A fragmen-

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Publication No. 10.

tary skin from Foo-chow, included by him as possibly representing *R. cornutus pumilus*, may have been the present form. The nose-leaf has the characteristic form of the species, with the sella slightly constricted in the middle, and its rounded tip narrower than its base. The horn on the connecting process is nearly an isosceles triangle in side view. The dark-gray immature pelage is practically alike in both races. Twelve skins from Fukien Province represent this lowland form and fourteen from Szechwan are assumed to be typical of *szechwanus*.

***Rhinolophus episcopus*, new species**

TYPE.—Adult male, skin and skull, No. 56895, American Museum of Natural History, from Wanhsien, Szechwan Province, China. Third Asiatic Expedition. October 9, 1921.

DESCRIPTION.—A small species of the *macrotis* group. Ears large and broad, with a wide trapezoidal antitragus, about 7 mm. across, well marked off by a deep notch. Horseshoe of the nose-leaf broad, quite covering the muzzle, with a narrow median anterior notch. On each side below the horseshoe is a small supplementary outgrowth extending back nearly to the level of the nostril. Sella parallel-sided, with broadly rounded vertex, its base if anything narrower; the nasal lappets thin, their outer margins continuous with the sides of the sella, and vertically raised, to form a shallow cup at the base of the sella. The connecting process is well developed, commencing about a millimeter below the summit of the sella, prominent and convex. The terminal leaf instead of being pointed is ovate, with convex sides and rounded tip, recalling a bishop's mitre. It is thin and leaf-like, about as high as the sella itself (5 mm.) and stands erect between the ears. Front face of the sella as well as the terminal leaf with numerous minute hairs, smaller than those rising from the connecting process. Two pairs of much longer hairs rise from the sides of the latter and exceed the leaves in height.

Wings from the metatarsus. Third metacarpal shortest, fourth and fifth of equal length. Second phalanx of third finger one and one-half times the first. Tail about as long as combined tibia and hind foot.

Color above, smoke gray, the hairs dull whitish at their bases. Below, the chin, throat and middle of the abdomen are pale, almost white, the hairs at the sides of the body smoky (near "avellaneous"), paler at their bases.

The skull is characteristic of the group, with very low sagittal ridge, prominent globular nasal swellings, narrow zygomata, and a broad palatal bridge, equalling one-half the maxillary tooththrow. The small  $p^2$  is fully in the tooththrow and the third upper molar has its W-pattern nearly complete, the posterior commissure about half the length of the anterior. In the lower jaw the small premolar is external to the row on one side, and partly so on the other.

MEASUREMENTS.—Collector's measurements of the type are: head and body, 51 mm.; tail, 24; foot, 10; ear, 26; spread, 275. The forearm measures 47.5 mm.; the third metacarpal, 34.5; fourth and fifth metacarpals, 36; tibia, 18.

The skull measures: occiput to front of canine, 19 mm.; occipital condyle to front of canine, 17; palatal bridge, 3.7; mastoid width, 9.2; zygomatic width, 8.2;

maxillar width, 6.2; width outside canines, 4.4; maxillary toothrow, 7; length of mandible, 12; mandibular toothrow to front of canine, 7.2.

This is a larger species than *macrotis* with a peculiar terminal nose-leaf, which is rounded rather than pointed. Like *pearsoni*, it is represented in the low coastal area by a smaller, brighter-colored race which may be named as follows.

#### ***Rhinolophus episcopus caldwelli*, new subspecies**

TYPE.—Adult female, skin and skull, No. 44771, American Museum of Natural History, from Yuki, Fukien Province, China. H. R. Caldwell, collector. October 31, 1916.

DESCRIPTION.—Similar to the typical form but smaller (forearm 43 mm., against 48), the pelage above with a warmer, cinnamon tint, near "saya brown," instead of smoky. The difference in tint is similar to that separating the upland and lowland races of *R. blythi* in China, and the differences in measurements are obvious from the following. The teeth are strikingly smaller. The small  $p^3$  is full in the toothrow and has a long sharp cusp. The lower premolars are not crowded.

MEASUREMENTS.—Forearm, 43 mm.; tibia, 17; foot, 9; third metacarpal, 31.5; fourth and fifth metacarpals, 33. Skull: occiput to front of canine, 18 mm.; occipital condyle to front of canine, 15.5; palatal bridge, 3; mastoid width, 8.5; zygomatic width, 7.8; maxillar width, 6.7; width outside canines, 3.7; maxillary toothrow, 6; length of mandible, 11.4; mandibular toothrow to front of canine, 6.5.

The single specimen on which this form is based differs so strikingly from the Szechwan series that there can be no doubt of its distinctness. It was found in a cave at the summit of a mountain by Mr. H. R. Caldwell, whose coöperation has resulted in the addition of many interesting species and in whose honor the form is named.

#### ***Rhinolophus rex*, new species**

TYPE.—Adult female, skin and skull, No. 56890, American Museum of Natural History, from Wanhsien, Szechwan Province, China. October 12, 1921.

DESCRIPTION.—A large member of the *macrotis* group, with ears, horseshoe and sella enormously enlarged, but the terminal lancet much reduced.

Ears large, almost funnel-like, the antitragus fully half their height and almost an isosceles triangle with broadly rounded point, marked off by a deep notch from the rest of the conch. Horseshoe very broad extending far (at least 3-4 mm.) beyond the sides of the muzzle, with a deep narrow median cleft anteriorly. There is no accessory outgrowth external to it. The lappets covering the nostrils at the base of the sella are much enlarged, thin and membranous, about the width of the muzzle, their edges slightly raised to form a cup and their posterior wings enclosing the base of the sella. The latter is large, about 9 mm. high in the dried specimen (11 as measured by the collector), tongue-shaped, narrowest at base, and gradually expanding to the broadly rounded summit, which stands upright between the ears. Its front face is thickly beset with microscopic whitish hairs. The connecting process commences

about 4 mm. below the summit and is relatively low with a convex outline. The terminal lancet is very small, almost concealed by the fur of the occiput, and does not quite reach the summit of the connecting process in height. Its summit is broadly rounded instead of pointed.

The wings arise from the metatarsus slightly below the toes. Calcaneum slender, about  $1\frac{1}{2}$  times the length of the foot. Tail with its tip projecting. Third metacarpal slightly the shortest, the fourth and fifth practically of equal length. The second phalanx of the third digit barely exceeds  $1\frac{1}{2}$  times the first; that of the fourth is less than  $1\frac{1}{2}$  times the first phalanx.

Fur rather long, about 16 mm. on the back, 10 mm. on the chest. In color it is light "cinnamon-buff" above, paler below except at the extreme sides under the arm-pits. A thin fringe of hairs borders the inner edge of the ear conch and the rib parallel to it on the lower three-fifths of the ear.

The skull is peculiar in having the surface of the braincase above the ear cancellar or spongy in appearance with numerous small fenestræ as far forward as the orbit. The nasal swellings are elliptical, with a deep cavity behind, but the sagittal crest is very low. The small  $p^2$  is fully in the toothrow, or even with a hair-space behind it and has a well developed cusp. In the lower jaw the minute middle pre-molar ( $p_3$ ) is fully in the row in all four specimens.

MEASUREMENTS.—The collector's measurements of the type are: head and body, 55 mm.; tail, 38; foot, 10; ear, 33; stretch of wings, 356. The forearm measures 58 mm.; third metacarpal, 41.5; its first phalanx, 17; its second, 26; fourth metacarpal, 43; its first phalanx, 12.7; its second, 17; fifth metacarpal, 43; tibia, 21.

The skull measures: occiput to front of canine, 22 mm.; occipital condyle to front of canine, 19.8; palatal bridge, 4.5; mastoid width, 11; zygomatic width, 10; maxillary width, 7; width outside canines, 4.8; maxillary toothrow, 8; length of mandible, 13.5; mandibular toothrow to front of canine, 8.

This extraordinary bat is a most interesting discovery. The exaggerated development of its anterior nose-leaves is in contrast to its otherwise primitive structure in the unspecialized wing and the unmodified position of the small premolars. The addition of this and the preceding species to the known Asiatic members of the *macrotis* series is of importance as pointing to the origin of the group from the central Asian land mass. The four specimens were captured in the Yen-ching-kao cave, whence also was obtained the Szechwan series of *Rhinolophus episcopus*.

### **Hipposideridæ**

#### **Hipposideros armiger swinhoii (Peters)**

*Phyllorhina swinhoii* PETERS, 1870, Proc. Zool. Soc. London, p. 616.

In his review of the horseshoe bats of the *armiger* group, Andersen (1906, Ann. Mag. Nat. Hist., (7) XVII, p. 37), working mostly with alcoholics, placed Peters' name *swinhoii* in the synonymy of this species. The fine series of skins obtained in Fukien Province, Szechwan and

Yunnan seems to show clearly that those from the coast are uniformly more brightly colored, with a strong buffy suffusion. The name may therefore be revived in a subspecific sense for the eastern, lowland form, type locality Amoy, Fukien Province.

### **Vespertilionidae**

#### ***Myotis chinensis luctuosus*, new subspecies**

**TYPE.**—Adult male, skin and skull, No. 56867, American Museum of Natural History, from Wanhhsien, Szechwan Province, China. October 12, 1921. Third Asiatic Expedition.

**DESCRIPTION.**—A large, dark *Myotis*, differing from typical *chinensis* of the lowlands in having the under surface evenly gray, instead of with black sides.

Color above a uniform grayish brown, nearly "buffy brown" of Ridgway (1912), the top of the head a trifle grayer; below uniformly gray, the hairs nearly fuscous at their bases with a minute whitish tip, which gives an evenly frosted appearance, darkened by the bases of the hairs showing through.

The calcar is long and slender, without keel. At the base of the fifth metacarpal a prominent membranous slip extends from the lower side of the carpus to the inner base of the digit.

The skull is obviously larger than that of a specimen of *chinensis* from Yunnan, though the forearm is no longer. In both, the second small upper premolar ( $p^3$ ) is drawn slightly in from the toothrow. There is no protoconule nor hypocone on the molars.

**MEASUREMENTS.**—The collector's measurements of the type are: head and body, 80 mm.; tail, 65; foot, 16; ear, 21; spread of wings, 456. The forearm measures, 65 mm.; third metacarpal, 64; fourth metacarpal, 62; fifth metacarpal, 59.

In the following measurements of the skull, those of a specimen of *chinensis* from Yung-chang, Yunnan Province, are added in parenthesis; greatest length, 24 (22.5); basal length, 22.5 (21); palatal length, 13.4 (12.4); mastoid width, 11.5 (11); zygomatic width, 15.5 (14.9); maxillary width, 9.7 (9.5); upper toothrow, 11.5 (11.3); lower toothrow, 12.2 (11.5).

A series of these large bats was secured in the same cave, Yen-ching-kao, from which the two new *Rhinolophi* came. They agree closely in the characters given. A specimen of typical *chinensis* from Fukien Province is a much richer brown than any of the Szechwan series, and it is likely that this is a further difference separating the two races. Tomes, in his original description, gave no locality for his specimen beyond "China." It was received from "Mr. Fortune," a botanist who collected in southeastern China, hence undoubtedly came from somewhere along that coast, perhaps from Shanghai, where he obtained other bats. The contrasting black sides are mentioned as a distinguishing character.

***Myotis frater*, new species**

TYPE.—Adult male, alcoholic, No. 48039, American Museum of Natural History, from Yenping, Fukien Province, China. August 10, 1920. H. R. Caldwell, collector.

DESCRIPTION.—A small species, structurally similar to *M. volans*, the long-legged bat of western North America, but differing in details, as follows.

Tail long, as in *volans*, about 50 per cent of total length; tibia very long, exceeding those of *volans*; foot much less than half its length equalling that of *volans*. Like the latter, the calcar has a low but evident keel about the length of the tarsus from the ankle. Wings ample, the metacarpals graduated, that of the third digit nearly reaching the elbow but falling short of it by 1.5 mm. Ears short, barely reaching the muzzle when laid forward, their tips less abruptly rounded off than in *volans*. Tragus similar in both, short, its anterior edge slightly concave, its lower half broad, the posterior upper margin slightly crenulate and abruptly bevelled off to the tip.

Below, the fur extends thinly on the under surface of the wing to a line from the middle of the femur quite to the elbow, as characteristic also of the American species. Its color is not evident in the alcoholic specimens, but is doubtless dark reddish brown as in *volans* of the Pacific coast of California.

The skull resembles closely that of the American species in its short, upturned rostrum, elevated forehead (in profile) and slightly inflated braincase. An important but minute detail of agreement is the conformation of the sagittal crest. Among the American species this is characteristic in that the temporal ridges, after uniting anterior to the occiput are continued back to meet the lambdoid crests not as concave but as convex lines.

The teeth in both are small and weak, but in the Asiatic species the second small upper premolar is much crowded inward from the tooththrow instead of standing practically in the row, and it is proportionally as well as absolutely smaller than in the American bat. Similarly in the lower jaw the second premolar is more reduced in size and crowded a very little inward from the row.

MEASUREMENTS.—Total length, 94 mm.; tail, 47; foot, 8; ear from meatus, 11; forearm, 39; tibia, 20; combined length, knee to end of claw, 29. Skull: greatest length, 13.5; basal length, 13.2; palatal length, 6.6; maxillary width, 5.9; zygomatic width, 9.2; mastoid width, 8; maxillary tooththrow, 5; mandibular tooththrow exclusive of incisors, 5.4.

A most interesting discovery is this Asiatic counterpart of *M. volans* (long known as *M. longicrus*) of western North America, with which it agrees in all important structural details, though with even more elongated tibiae and more progressive dentition in that the minute premolar 3 in both jaws has gone farther on its way to entire suppression. The more primitive condition of the American species indicates that it was derived from the Asiatic bat. The three specimens were found in holes of live bamboos on mountains at 2500 feet elevation. The bats of this group are distinguished by the combination of short ears, long tibiae, keeled calcar, fur extending to elbow ventrally, inflated skull with short rostrum, elevated occiput, and convex outline of temporal ridges at occiput.

**Nyctalus velutinus**, new species

TYPE.—Adult male, skin and skull, No. 44649, American Museum of Natural History, from Futsing, Fukien Province, China. Edmund Heller and R. C. Andrews, collectors. July 29, 1916.

DESCRIPTION.—Color above Prout's brown; below paler, near Dresden brown of Ridgway, slightly grayer on the chest. The bases of the hairs are darker, fuscous, both above and below.

On the dorsal surface, the fur of the body extends out as far as a line joining the proximal half of the humerus and the knee, and back on the interfemoral membrane nearly to a line joining the middle of the tibiae. Below, the wing membrane is thickly furred from the knee to the basal third of the fifth digit and on the base of the fourth digit, as well as on the propatagium and the under side of the humerus itself. The extent of fur on the interfemoral membrane is much like that on its dorsal side.

MEASUREMENTS.—The collectors' measurements of the type are: head and body, 75; tail, 52; foot, 11; ear, 15. The forearm measures 49 mm.; third metacarpal, 49.5; first phalanx of same, 18; second phalanx, 21.5; fourth metacarpal, 48; first phalanx of same, 18; second phalanx, 8.3; fifth metacarpal, 39.5; first phalanx of same, 9.3; second phalanx, 5.3.

The skull measures: greatest length, 18; basal length, 18.3; palatal length, 9; mastoid width, 11.2; zygomatic width, —; maxillary width, 8.5; upper tooththrow to front of canine, 7; mandible, 13; lower tooththrow to front of canine, 7.3.

I have been unable to reconcile the characters of this Chinese noctule bat with those of any of the described species. In a previous paper (1912, Mem. Mus. Comp. Zoöl., XL, p. 243), I referred specimens from Ichang and eastern Szechwan to Hodgson's *labiatus*, but this seems to be a larger animal, though the two may eventually prove to be but sub-specifically related. Until a more thorough study of their distribution and relationships can be made, the eastern bat may stand as a full species.

**Miniopterus schreibersi parvipes**, new subspecies

TYPE.—Adult male, skin and skull, No. 44656, American Museum of Natural History, from Yenping, Fukien Province. Roy C. Andrews, collector. June 16, 1916.

DESCRIPTION.—In general similar to *M. schreibersi chinensis* Thomas from Chili Province, but the coloring much richer, a deep brownish instead of smoky gray, and the hind foot shorter and narrower.

Color of the type, a uniform dark cinnamon-brown above, nearly "Verona brown" of Ridgway; below slightly paler, about "snuff brown." On the lower parts the roots of the hairs are darker, but on the back they are nearly uniform, only a shade deeper in color at their bases.

The females, as usual in this genus, are darker than the males, from chestnut-brown to blackish.

MEASUREMENTS.—The forearm and finger measurements are the same as in the more northern form, but the foot is smaller and more slender. The type measures: forearm, 48; third metacarpal, 43.5; first phalanx, 10.5; second phalanx, 39; fourth

metacarpal, 42; first phalanx, 8.5; second phalanx, 19; fifth metacarpal, 39; tibia, 17; foot, 9.5 (10.5 in *chinensis*).

The skull measures: greatest length, 16; basal length, 15.5; palatal length, 8; mastoid width, 8.5; zygomatic width, 8.7; maxillary width, 6.5; upper tooththrow (exclusive of incisors), 6; mandible, 12; lower tooththrow (exclusive of incisors), 6.8.

A small series of these bats from Fukien Province is obviously different from others obtained in Chili Province, representing the subspecies *chinensis*. They are much browner and lack the dark smoky color of the latter which, in combination with the smaller and slenderer foot, will at once distinguish the more southern race. Its relation to the Indian *Miniopterus* remains to be studied further. In other respects the two seem sufficiently alike to make it probable that the South China form is only subspecifically distinct.



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## MURID RODENTS FROM THE ASIATIC EXPEDITIONS<sup>1</sup>

BY GLOVER M. ALLEN

In previous papers, brief accounts have been given of the rodents obtained in China and Mongolia by the Museum's Asiatic Expeditions under the direction of Dr. Roy Chapman Andrews, the last (Amer. Mus. Novitates, No. 217, June 16, 1926) comprising the genus *Rattus*. The present report includes the remaining members of the Gerbillinæ and Murinæ secured during the work of the same expeditions, a collection numbering over 1300 well-prepared skins and skulls. These add considerably to present knowledge of the distribution of many species, and indicate also that much yet remains to be done toward, for example, a more precise definition of the native forms of house mice as well as a more accurate knowledge of the distribution and relations of even the introduced *Mus musculus* in China. The aberrant genera *Hapalomys* and *Chiropodomys*, climbing species with feet modified for grasping, are recorded for the first time from Chinese territory, as well as a species of *Leggada*.

### *Meriones auceps* Thomas

*Meriones auceps* THOMAS, 1908, Proc. Zool. Soc. London, p. 640.

General color above sandy buff, inclining to reddish, inconspicuously lined with black; tail similar all around but slightly redder, its tip pencilled; cheeks and ear spot whitish. Below, the body and limbs are white to the roots of the hairs.

A large series was secured from various points in the Gobi Desert: Turin, Loh, Artsa Bogdo, Sair Usu, Tsagan Nor, and Iren Dabasu. It seems to be common here over a vast area, and in much the same localities as the following, from which it is said to differ in being wholly nocturnal instead of partly diurnal. Two specimens were also taken at Mai-tai-chao, east of Paotou, Shansi.

The shorter-tailed species, *M. psammophilus*, was not met with, and probably is confined to Chihli and Shansi, while *M. auceps* is chiefly an animal of the Gobi. Their ranges meet in northern Shansi as Thomas has indicated.

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<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 71.

***Meriones unguiculatus* (Milne-Edwards)**

*Gerbillus unguiculatus* A. MILNE-EDWARDS, 1867, Ann. des Sci. Nat., Zool., (5) VII, p. 377.

Similar to *M. auceps* but slightly darker, less clear ochraceous, the tail especially more mixed with black above. The white hairs of the lower surface are slaty at the base except on the throat.

A common and widespread species. Series were obtained in Shansi at Kweihwating, Mai-tai-chao, and in Mongolia at Loh, Sair Usu, Ussuk, Gun Burte, Artsa Bogdo, Tsagan Nor, and Iren Dabasu.

***Rhombomys opimus nigrescens* (Satunin)**

*Gerbillus opimus nigrescens* SATUNIN, 1902, Annuaire Mus. Zool. Acad. Sci. St. Pétersbourg, VII, p. 560.

A large sandy-buff species with a black crest on posterior half of tail; belly white, the bases of the hairs blue-gray.

A series of adults and partly grown animals from Tsagan Nor represents this race, the type of which is from Orok Nor, some fifty miles to the westward. A single skin from Iren Dabasu extends the range well to the east. Satunin points out that this Gobi race is paler than its nearest relative, *R. o. giganteus* of the Nan-shan country. The latter, as figured by Büchner, has brighter ochraceous feet and the black crest of the tail is traceable nearly to its root instead of being confined to the terminal half. Büchner refers Ala-shan specimens to typical *opimus*, but presumably they are *nigrescens*. He doubts the validity of *Rhombomys* as a genus, but it may stand for the present on the basis of (1) the second inner minute sulcus of the upper incisor, (2) the more or less well-marked division of the last upper molar into two lozenge-shaped portions by infolding of the enamel, and (3) the uninflated auditory meatus. The skull has a sharp supraorbital boundary and flattened top, while the interparietal is small and oblong or squarish in outline, unlike that of the species of *Meriones* found in the same region.

***Apodemus speciosus peninsulæ* (Thomas)**

*Micromys speciosus peninsulæ* THOMAS, 1907, Proc. Zool. Soc. London, p. 862.

A medium-sized mouse (head and body about 102 mm., tail 90), of a nearly uniform ochraceous buff above in winter pelage, finely lined with black hairs mid-dorsally, tail bicolor, feet white, belly and under side of limbs white with slaty bases. In summer the color is much darker above, the black tips of the hairs predominating, and the dorsal pelage tends to be somewhat hispid. Mammæ 4-4=8. The last upper molar has three lobes on its inner side.

The type locality of this race is Min-gyong, 110 miles southeast of Seoul, Korea, and specimens from North China are currently regarded as the same. Two skins in winter pelage from Nojido, Korea, are appreciably more cinnamon in color as compared with a series from 100 miles northeast of Peking and seem to have slightly larger hind feet. They may for the present, however, stand as *A. speciosus peninsulæ*, and specimens from Shensi (Tai Pei Shan and near Fengsiangfu) and Shansi (Taiuangfu, He-shuin and Kweihwating) are similar. Two skins from 45 miles north of Urga, Mongolia, are not distinguishable from a large series taken in summer at the Eastern Tombs, Chihli.

#### ***Apodemus speciosus latronum* Thomas**

*Apodemus speciosus latronum* THOMAS, 1911, Abstr. Proc. Zool. Soc. London, No. 100, p. 49, October 31.

A larger mouse than the preceding (head and body 105 mm., tail 117) with larger ears (20-21 mm.); tail equalling or exceeding body length. Longest hairs of the back measure about 14 mm. Dorsal area with greater admixture of black hairs than in *A. s. peninsulæ*.

This seems to be a large-eared, darker representative of *A. speciosus*, though specimens showing direct intergradation of the two forms have not been seen. The type locality is Tatsienlu, Szechwan, and Thomas has recorded it from Atuntsi, from the Lichiang range, 10,000 to 12,000 feet, and the Mekong-Salween divide, 9000 feet, all in Yunnan. It was found by Dr. Andrews on the Lichiang range up to timberline at 13,000 feet as well as at localities northward toward Chung-tien. Immature specimens lack almost altogether the strong ochraceous tint of the adults, but are instead a dark gray.

#### ***Apodemus ilex* Thomas**

*Apodemus ilex* THOMAS, 1922, Ann. Mag. Nat. Hist., (9) X, p. 404.

A slender brownish mouse, tail slightly longer than head and body. Color above, dull fulvous brown darkened by black hairs medially, sides clearer buff. Ears thin, small, with a blackish basal tuft. Below whitish, the hairs with slaty bases. Usually a buffy spot is present at the throat, and in some specimens more or less of the entire under surface is suffused with the same color. The longest hair on the back is about 7 mm. in length.

In its general appearance and structure this is very similar to the common *A. sylvaticus* of Europe of which it may prove to be merely a subspecies. It agrees in tooth structure and in having  $1-2=6$  mammae as well. The nasals, however, equal or exceed the premaxillaries instead of being shorter, and the post-palatal border ends in a slight median spine instead of an even arch. Originally described from the Mekong-

Salween divide in Yunnan, it was secured in numbers by the Asiatic Expeditions at various localities in the same province at altitudes ranging from 7000 feet on the Salween River to 12,000 feet in the Lichiang region. Specimens in the Museum of Comparative Zoölogy from Szechwan and Hupeh are indistinguishable and extend its known range northward.

***Apodemus agrarius pallidior* Thomas**

*Apodemus agrarius pallidior* THOMAS, 1908, Proc. Zool. Soc. London, p. 8.

A tawny mouse, with a narrow and not very sharply defined black line from nape to tail. The color above is light ochraceous buff evenly mixed with black, but usually paler over the shoulders and on the sides than in the center of the back. Lower surfaces and feet whitish, the body hairs with dark bases. Tail indistinctly bicolor, shorter than head and body. Last upper molar with but two instead of three inner lobes.

Originally described from Shantung, this form seems to extend westward to southern Kansu and eastern Szechwan. A large series from the base of Tai Pei Shan, Tsingling Mountains, southern Shensi, is fairly uniform, and is not appreciably different from a series taken at Wanh sien in eastern Szechwan. The narrowness but usual presence of the dorsal line as well as the indefinite grayish tint of the shoulder area are distinguishing features. In a very few of the large series from Wanh sien, the black stripe is obsolescent, showing in this respect a transition toward the race *ningpoensis*.

***Apodemus agrarius mantchuricus* (Thomas)**

*Mus agrarius mantchuricus* THOMAS, 1898, Proc. Zool. Soc. London, p. 774.

A mouse with a broad clear line of black from the nape to base of tail; remainder of upper surfaces a uniform ochraceous buff mixed with black, paler at the sides; lower surfaces and feet white, tail bicolor.

Four adults of the striped-backed mouse from the Eastern Tombs, Chihli Province, are richer in tone than the preceding race, and three have the dorsal stripe much broader and clearer black, though in the fourth it is narrower. These are probably referable to *mantchuricus* though the belly is without the wash of tawny said to be characteristic of this race. No doubt they are somewhat transitional here between the two races.

***Apodemus agrarius ningpoensis* (Swinhoe)**

*Mus ningpoensis* SWINHOE, 1870, Proc. Zool. Soc. London, p. 637.

In the South China race, the black dorsal stripe tends to disappear and is developed chiefly on the middle of the back from shoulders to rump; the color of the body is slightly brighter, the tail slightly longer and more sharply bicolor than in *A. a. pallidior*.

A series from Yochow, Hunan Province, represents this subspecies. Of thirty-two specimens three or four have the black stripe about as well developed as in the form *pallidior*, but the majority have it very poorly marked or nearly obsolete on the lower back, while eight or ten either lack it altogether or have merely the faintest indication, discernible only on close scrutiny. This series evidently bridges the gap completely between *A. a. pallidior*, *A. a. ningpoensis*, and the form *chevrieri* which has hitherto been regarded as a separate species, but which, as Thomas has already suggested, is undoubtedly merely an upland race in which the dorsal stripe is wholly lacking.

***Apodemus agrarius chevrieri* (A. Milne-Edwards)**

*Mus chevrieri* A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. Mammifères,' p. 288, Pl. XL, fig. 2.

Similar to *A. a. pallidior* but slightly richer, less grayish, in coloration and wholly lacking the black median dorsal line. Back darkened by an even admixture of black-tipped hairs; the sides more nearly clear ochraceous buff, a tint that is obviously brighter on the posterior part of the body.

There seems to be no doubt that *chevrieri* is after all but an upland race of *A. agrarius* in which the black dorsal stripe is lacking. A series from Yochow (Hunan), as noted, seems to bridge the gap, and elsewhere, as at Hsienshanhsien, Hupeh Province (specimen in Museum of Comparative Zoölogy) and in southern Kansu (the *Apodemus fergussoni* of Thomas), intermediate individuals seem to occur.

A very large series of this mouse was secured from various localities in western Yunnan at altitudes from 6000 feet (Taku Ferry, Yangtse River) to 12,000 feet (Lichiang). There is very little variation in color, though two skins from 7000 feet at Mucheng, Salween drainage, seem slightly brighter in tint than the average, and constitute the most south-westerly record for the species.

Six females taken October 5, 1916, at 9000 feet, near Lichiang, contained embryos, from four to seven in number.

***Leggada cookii* (Ryley)**

*Mus cookii* RYLEY, 1914, Journ. Bombay Nat. Hist. Soc., XXII, p. 664.

Size and general appearance of a house mouse but tinged with ochraceous, and lower parts whitish with slaty bases of the hairs showing through; tail slightly longer than head and body.

The characters separating the house mice (*Mus*) from the jungle mice (*Leggada*) have recently been reviewed by Thomas (1919, Journ. Bombay Nat. Hist. Soc., XXVI, p. 417), and the latter genus with its

longer muzzle is shown to be a distinct and natural group (distance from gnathion to front bottom corner of zygomatic plate exceeding breadth across molars).

Four specimens from the Namting River, near the Burma border, western Yunnan, 1700 feet, are referred to this species, the type locality of which is Gokteik, northern Shan States, Burma. In addition to the color and proportions, it is further distinguished from the other jungle mice by the skull with braincase exceeding 10 mm. in width, and with the incisive foramina extending back to the molars or very slightly between them. This is apparently the first record of the genus in Chinese territory, although Thomas has recorded *L. pahari* from near the southern border of Yunnan in Tonkin. In addition to the four from the lower levels of the Namting River, a series was also secured from higher altitudes in western Yunnan, which differs uniformly in the much grayer coloring, as described below.

***Leggada cookii meator*, new subspecies**

TYPE.—Adult male, skin and skull, No. 43609, American Museum of Natural History, from Taipingpu, Shweli River, western Yunnan, 8000 feet. April 9, 1917. R. C. Andrews and E. Heller.

DESCRIPTION.—Dorsal surfaces of a general drab or dark mouse gray, resulting from a mixture of stronger slate-colored hairs with finer, dark-based hairs narrowly tipped with pale ochraceous. Ears thinly haired, dusky; feet white. Lower surfaces gray, not sharply marked off from the color of the sides, the hairs pale gray at base, their terminal half whitish. Tail about equalling or slightly exceeding head and body, sparsely haired, its rings evident; above dusky, below whitish.

SKULL.—The skull agrees in its general characters with those given for *cookii*. The brain case is broad, oval, with a strap-shaped interparietal, produced forward to a blunt point medially. The orbital edge is square but not conspicuously thickened, and the outer corners of the parietals project forward as a tapering process, overlapping the frontals slightly. Nasals long, extending back about a millimeter behind the level of the front edge of the orbits. The incisive foramina usually fall just short of the molar level, though rarely they may extend a minute distance between the anterior molars, and the convex front edge of the zygomatic plate is slightly behind their middle point. Teeth as in *Mus*, with the notch on the upper incisors usually well developed.

MEASUREMENTS.—The type was measured by the collectors as follows: head and body, 87 mm.; tail, 80; hind foot, 20; ear, 14. The skull measures: greatest length, 23.8 mm.; basal length, 20.5; palatal length, 11.8; diastema, 5.7; zygomatic breadth, 11.6; mastoid breadth, 10; breadth of brain case, 11.1; gnathion to front bottom corner of zygomatic plate, 5.8; greatest breadth across molars, 5.0; upper molar row, 4; lower molar row, 4.

A series of eighteen of these jungle mice from localities in the mountains of western Yunnan agree in their dull gray or drab coloration and differ markedly from the much brighter, more rufous representatives of

the species from the lower country along the Burma border (1700 feet). Specimens were taken at Homushu Pass (8000 feet); Sha-sung-shao, Mekong drainage (7500 feet); Taipingpu, Shweli River (8000 feet); Tashuitang, Salween drainage (6000 feet); and Yangpi River, Tengyueh road (5000 feet). They bear a certain superficial resemblance to *Apodemus ilex*, but may be distinguished by the shorter ear and hind foot, while a glance at the skull with its *Mus*-like teeth, incisive foramina penetrating to the molar level, and the antero-lateral projection of the parietal will at once separate the two. Their ranges meet at about the 7000-foot level, below which the *Leggada* seems to take the place of the other. The extension of this Oriental group into extreme western Yunnan is an interesting discovery.

***Micromys minutus pygmæus* (A. Milne-Edwards)**

*Mus pygmæus* A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. des Mammifères,' p. 291, Pl. XLIII, fig. 1.

A small mouse of a dull yellowish brown above, somewhat more ruddy over the rump, the hairs of the lower surfaces dark-based, tipped with gray and more or less washed with buffy. Tail slightly longer than head and body, its extreme tip nearly or quite bare above.

A small series of the harvest mouse was secured by the Asiatic Expeditions at Wanhshien, 2500 feet, in eastern Szechwan, and at several localities in western Yunnan on the Mekong and Salween drainages, 4000 to 8000 feet. The type locality is Moupin, Szechwan. All the specimens are very uniform in coloration.

***Mus musculus* Linnæus**

*Mus musculus* LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 62.

In the introduced house mouse the belly hairs are either gray throughout or gray washed with ochraceous. Specimens of the latter type from India are referred by Wroughton to *Mus dubius*. A series from Yenping, Fukien Province, China, taken by Rev. H. R. Caldwell, shows both extremes, but is regarded as *musculus*, here introduced. Cabrera has recently proposed the name *Mus musculus sinicus* for the house mouse of eastern China (type locality, Ningpo, Chekiang Province), on the ground of small size, dark color, and ochraceous wash below as compared with Indian specimens representing *Mus musculus urbanus*. The differences, however, seem likely to fall within the range of normal variation for the typical race. A single skin from Lichiang, 9000 feet, Yunnan Province, seems also to be the introduced variety.

**Mus bactrianus GROUP**

Small sandy-backed, white-bellied mice with the general appearance of the European house mouse seem to occur in a wild state over much of temperate and subtropical Asia. The oldest name available for these is apparently *Mus bactrianus* Blyth, 1846, the type locality of which is Kandahar, central India. Wroughton (1920, Journ. Bombay Nat. Hist. Soc., XXVI, p. 958), in summarizing the work of the Mammal Survey of India, includes but this single form of white-bellied house mouse from that country, and Thomas has suggested further that it may be found to merge with typical *Mus musculus* through such a form as *gentilis*. The American Museum of Natural History has a series from Kashmir and Ladak that corresponds entirely with the description of *bactrianus*. These are pale sandy above (a buffy gray), white below, with the bases of the hairs on the lower surfaces blue-gray; the feet are white, the tail is obviously paler below, and it is shorter than the head and body, averaging 47% of total length in a series of 16 (extremes 46 and 50%).

The work of the Asiatic Expeditions under Dr. R. C. Andrews has resulted in bringing together a large series of mice of this type from China and Mongolia, while others are available in the Museum of Comparative Zoölogy through the F. R. Wulsin Expedition. A study of the entire lot makes it clear that in western Yunnan and southeastern China the representatives of *bactrianus* are relatively longer-tailed, with tail more than 50% of the total length, while the hairs of the lower surfaces have more extensive gray bases, giving a darker effect. The specimens available from Szechwan are again different, with proportionally shorter tails and a decided buffy collar often extended as a buffy wash over the white belly. Passing northward to the dry country of Shensi and northern China there is a progressive shortening of the tail and paling of the color, until the edge of the Gobi Desert is reached with a very short-tailed mouse having a pure white belly to the roots of the hairs. The first of these races corresponds exactly with Anderson's description of *Mus kakhienensis* from Ponsee near the border of western Yunnan; to the second no name seems to have been given; while for the third, *Mus gansuensis* Satunin is available, with *Mus wagneri mongolium* Thomas as a synonym. The relationship of *Mus wagneri* Eversmann (1848) from Turkestan, to the other members of the group is apparently still in need of further elucidation.



**Mus bactrianus kakhyenensis** Anderson

*Mus kakhyenensis* ANDERSON, 1878, 'Anat. and Zoöl. Researches Western Yunnan,' p. 307.

Above sandy, the central area of back darkened slightly with black hairs; below, white, the hairs with obvious gray bases showing through; feet white; tail longer than head and body, distinctly white below.

Five specimens from extreme southwestern Yunnan near the Burma border (5000 feet) agree in every respect with Anderson's description of *Mus kakhyenensis*, of which they are nearly topotypes. The tail is obviously longer than head and body amounting to 53% (average of five specimens) of total length, a character which, with the more prominently gray bases of the hairs below, will distinguish the form from typical *bactrianus*. In addition to these, the collections include a large series from the island of Hainan taken by Mr. Clifford Pope and two from the adjacent mainland of Fukien, all quite similar except that the tail length averages a little less, about 51.6% of total length. Probably, therefore, this race extends across the entire southern part of China at lower levels. It is also an addition to the recorded fauna of Hainan.

**Mus bactrianus tantillus**, new subspecies

TYPE.—Adult female, skin and skull, No. 56413, American Museum of Natural History, from Wanhsien, Szechwan Province, China. November 14, 1921. Third Asiatic Expedition.

DESCRIPTION.—Tail nearly or quite equalling head and body (averaging 49% of total length); hairs of the belly dark-based, tipped with white; throat buffy.

Above, the color is sandy, resulting from a mixture of buffy-tipped with black hairs, the latter more numerous over the rump, giving a slightly darker effect mid-dorsally. Sides clearer buffy. Lower surfaces with the hairs gray-based, tipped with white. Throat with a buffy collar. A suffusion of buffy may extend to most of the under surfaces. Ears dusky. Feet dusky, the toes whitish; tail indistinctly bicolor. Mammaræ 3-2=10.

SKULL.—The skull shows no special peculiarities. The backward extension of the incisive foramina nearly to the level of the antero-internal root of  $m^1$ , the narrow mesopterygoid fossa with a slight median projection of the palate at its anterior end, and the forward prolongation of the parietals to a slender point on each side are characters found in other races.

MEASUREMENTS.—The type was measured by the collector as follows: head and body, 78 mm.; tail, 70; hind foot, 15; ear, 12.

The skull of the type measures: greatest length, 20 mm.; basal length, 17; palatal length, 10.3; diastema, 5; zygomatic width, 10.9; mastoid width, 9; width of braincase, 9.5; upper cheek teeth, 3.5; lower cheek teeth, 3.5.

A series of these mice from Wanhsien, eastern Szechwan, agrees in having the tail about half the total length (average of eight, 49%), the

belly with gray bases to the hairs, the throat with a buffy collar, and the hind feet dusky. To the north, intergradation takes place with the short-tailed desert race, *gansuensis*. Thus, while specimens from Tai Pei Shan are typical, a series from 45 miles south of Fengsiangfu, Shensi, has the tail still shorter, averaging 46% of total length, the buffy collar is usually absent (present in two of six), the feet are white and the dark bases of the belly-hairs less extensive. Six in winter pelage from near Peking are fairly typical, though in one the buffy collar is reduced to a median spot. A single skin from Eastern Tombs, Chihli, has the belly and throat white to the roots of the hairs, as in the subspecies following. Specimens from eastern China have not been seen.

This is a species apparently of open and cultivated fields, but comes into the human habitations as well, with much the familiarity of the common house mouse. It seems altogether likely that some form of this Chinese mouse represents the original stock from which the tame black-and-white waltzing mouse of Japan is derived. The evidence on this point has recently been summarized by Gates (1926, Publ. Carnegie Inst. Wash., No. 337), while Fortuyn (1912) has proposed the name *Mus wagneri rotans* for the tame animal, a name which on account of the shortness of the tail-to-total-length ratio may be included in the synonymy of the race *gansuensis*.

***Mus bactrianus gansuensis* Satunin**

*Mus* (*Leggada*) *gansuensis* SATUNIN, 1902, Annuaire Mus. Zool. St. Pétersbourg, VII, p. 564. Kansu.

*Mus wagneri mongolium* THOMAS, 1908, Proc. Zool. Soc. London, p. 106.

This is a pallid, short-tailed race characteristic of the desert country from eastern Mongolia southwestward across northern Shansi to Kansu. Its relationship to *bactrianus* seems evident but specimens from Central Asia are unavailable. The dorsal coloring is a pale sandy buff, not darkened medially, the lower surfaces and feet are pure white to the roots of the hairs, and the tail is indistinctly bicolor. In three Mongolian specimens, secured by the Asiatic Expeditions at Tsagan Nor, Gun Burte, and Ula Usa respectively, the tail averages 40% of the total length, but the feet and ears are as long as in the previous race. The measurements given for the type of *gansuensis* (from Tschortentan, Kansu) indicate a tail 42% of the total length. The Museum of Comparative Zoölogy has a series of skins collected by F. R. Wulsin near Yirgo, Shansi, that is quite the same, and it seems that those described from the edge of the Mongolian plateau north of Kalgan, Chihli, as *Mus wagneri mongolium* agree in

the characters given. Such specimens as those mentioned above from Eastern Tombs and southern Shensi are clearly intermediate between this and the previous race.

***Chiropodomys fulvus*, new species**

TYPE.—Adult female, skin and skull, No. 43989, American Museum of Natural History, from Yinpankai, Mekong River, western Yunnan, China, 9000 feet altitude. December 24, 1916. R. C. Andrews and E. Heller.

DESCRIPTION.—Pelage full and almost silky. Entire dorsal surfaces except the ears and tail, but including the backs of the fore and hind feet, fulvous, very slightly darkened over the lower part of the back by scattered fine black hairs. Cheeks and flanks clear bright fulvous. Forehead and top of head slightly darkened and grayer than the back. Ears sparsely covered with short hairs, fulvous on the inner surface; on the pro-ectote, however, contrastingly blackish. Under surfaces from chin to anus, the entire forearm, and the hind leg to near the ankle, white, not very sharply marked off at the sides. The chin and throat as well as the under side of the forearms are white to the roots of the hairs, but elsewhere the hairs are slaty for their basal half and a small median fulvous spot is present on the chest. A few hairs at the tips of the toes above are silvery white. Tail sparsely haired, with a slight terminal pencil; its color uniformly dusky except on its basal half below where it is buffy. Vibrissæ long, black, reaching to the tips of the ears.  $Mammæ 2-2 = 8$

SKULL.—The rostrum, as in other members of this genus, is relatively short (slightly more than one fourth the length of the skull), and there is practically no antorbital notch. Anterior edge of zygomatic plate is slightly concave. The brain-case is broad and somewhat flattened, the jugals are very slender, and the nasals, which extend back to the level of the zygomatic arch, are exceeded by the ascending branch of the premaxillaries. Very striking is the median groove or depression beginning at about the anterior third of the nasals and extending back to the border of the parietals. This depression is widest posteriorly and is bounded in the inter-orbital region by a rounded ridge on either side of the frontals. In ventral view, the incisive foramina just reach the level of the anterior molars, while posteriorly the interpterygoid fossa just about reaches the level of the hindmost molars. The first upper molar, as usual, shows three transverse rows of three tubercles each, with a postero-external accessory cusp. The second molar is similar except that the anterior row is so reduced that its median tubercle has disappeared. In its somewhat worn condition the last upper molar appears to consist of two transverse plates. In the lower jaw the coronoid process is as usual small. The first lower molar consists of an anterior trefoil followed by two transverse rows of three cusps each. The second molar consists of three transverse rows, each of three cusps, but the outer cusps are reduced in size, and the posteriormost row is so narrowed that it appears hardly more than a crescent-shaped ridge with a minute outer cusp.

MEASUREMENTS.—The collector's measurements are: head and body, 75 mm.; tail, 133; hind foot, 18.5; ear, 17. The skull measures: greatest length, 22.3 mm.; basal length, 18.5; palatal length, 10.6; length of nasals, 6.7; zygomatic width, 11.7; mastoid width, 9.5; upper molar row, 3.3; lower molar row, 3.8.

The single specimen of this small, bright-colored mouse with long tail agrees with *Chiropodomys* in having flat nails on the pollex and hallux only, and in having the latter opposable to the rest of the hind foot. The number of mammæ in the genus is said to be  $0.2 = 4$ , but in the present specimen is very clearly  $2.2 = 8$ . Its more slender proportions and the dark bases of the belly fur are obvious points of difference in comparison with other known members of the genus, of which this appears to be the first Chinese record.

***Hapalomys marmosa*, new species**

TYPE.—Adult female, skin only, No. 59046, American Museum of Natural History, from near Nodosa, island of Hainan, China. December 27, 1922. Clifford Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—General form rat-like, but with the hallux opposable, its terminal joint broad and provided with a flat nail. Other digits with compressed short claws, hardly exceeding the terminal pads. Tail slightly longer than head and body, scaly, nearly naked, its sparse short hairs hardly longer than the width of a scale-row except near the tip where they form a slight pencil and are about the length of four scale rows. Vibrissæ prominent, black, slightly longer than head. The otherwise nearly naked ears are remarkable for the long stiff hairs projecting out from the inner surface of the conch and there is a tuft of similar hairs at their anterior base.

The pelage is soft and fine in texture, about 12 mm. long mid-dorsally, of a nearly uniform dull reddish gray (near cinnamon, Ridgway, 1912) only slightly admixed with scattered blackish hairs. The sides are paler, the feet and limbs buffy gray. The entire under surface including fore legs, and the hind legs to below the knee, is pure white to the roots of the hairs. Ankles below, and tail with its short hairs, dusky.

SKULL.—The specimen is unfortunately unaccompanied by a skull so that a description of the cranial characters must await the collection of additional specimens.

MEASUREMENTS.—The type was measured by the collector as follows: head and body, 130 mm.; tail, 138; hind foot, 21; ear, 12.

The discovery of this genus in Hainan constitutes an addition not only to the known fauna of that island but to the fauna of China as well. It is a shorter-tailed animal than the Indian *H. longicaudatus*, with conspicuously hairy ears (a trait noticeable also in the arboreal octodont *Diplomys* of America). Like the other members of the genus it is doubtless a tree-liver, its grasping hind foot recalling that of an opossum.

## AMERICAN MUSEUM NOVITATES

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LAGOMORPHS COLLECTED BY THE ASIATIC  
EXPEDITIONS<sup>1</sup>

BY GLOVER M. ALLEN

The fine series of lagomorphs secured by the Asiatic Expeditions, under the leadership of Dr. Roy Chapman Andrews, includes some 85 hares from such widely separated localities as Mongolia and the Chinese provinces of Shensi, Chihli, Fukien and Yunnan, as well as 136 skins of mouse-hares or pikas chiefly from the Gobi Desert region. The latter appear to represent four well-marked types of which two, *Ochotona pallasi* and *O. dauurica*, are characteristic of the Gobi; a third, *O. hyperborea mantchurica*, is more northern, reaching the edge of the Mongolian plateau; while the fourth type is more characteristic of the high mountains of western China and is allied to the small brown species, *O. tibetana*. The large number of hares available has led me to attempt a revision of the Chinese forms of the black-tailed group to the extent of indicating their subspecific relationship and allocating some of the names previously applied. The harsh-haired rabbit, *Lepus sinensis*, is now referred to the genus *Caprolagus* and a new race is described from the mountains of northwestern Fukien; while from western Yunnan is described a new species of hare allied to *Lepus nigricollis* of India.

***Ochotona hyperborea mantchurica* Thomas**

*Ochotona (Pika) hyperborea mantchurica* THOMAS, 1909, Ann. Mag. Nat. Hist., (8) IV, p. 504.

A small species, with palatal and incisive foramina separate. Thomas has described the race of eastern Manchuria as slightly larger and brighter russet in color than specimens from the upper Amur region representing Schrenck's *O. h. cinereo-fusca*, and at the same time suggests that these may be a species distinct from *O. hyperborea*, though closely allied to it. The skulls of the latter are much smaller (skull length 31 as against about 40 mm.) and the summer pelage is apparently grayer.

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 74.

A series of over thirty skins was taken at a locality 45 miles north-east of Urga, Mongolia, by the Asiatic Expeditions. These average a very little smaller in measurements than those given for the Manchurian race, but the largest individuals are scarcely inferior to the latter, so that without Manchurian specimens for comparison they seem best considered identical. The presence of a colony of this boreal species near Urga brings its range well to the westward and carries its southern limit to the northern edge of the Gobi Desert. Most of the adults taken July 25-29 have acquired the bright russet pelage of summer though a few still retain on the rump and flanks a remnant of the longer winter fur of a pale ochraceous and black, while in one taken September 11 the new winter coat is coming in on the head, shoulders, and anterior back. The immature individuals of late July are in a dark gray pelage much intermixed with black, while adults are bright russet above, darkened on the middle of the back by black hairs, and on the belly the light tips of the hairs are washed with rusty.

***Ochotona dauurica* (Pallas)**

*Lepus dauuricus* PALLAS, 1776, 'Reise,' III, p. 692.

A uniform sandy ochraceous above, paler on the sides, feet white washed with buff above; prominent pale buffy patches behind ears. Below, the hairs are slaty at base, tipped with white; a buffy collar on the throat extends back medially as a wash of the same color to chest.

Superficially this species greatly resembles *O. pallasi* which occurs in the same localities with it in the Gobi Desert but may be recognized at once by its feet, the toe pads of which are completely hidden by short forwardly directed hairs, while in *O. pallasi* the pads are naked and obvious at a glance. In details the present species is slightly paler in color, the ochraceous tints not quite as bright on cheeks, sides and rump, the bright tuft of hair below the ear is lacking, and the upper lip is narrowly white like the chin instead of ochraceous like the rest of the head.

A specimen from Turin, Mongolia, May 11, is still in the full soft coat of winter, a pale and uniform ochraceous buff slightly darkened by the minute black tips of the hairs above. Specimens taken about May 18-20 show the new hair coming in on head and shoulders, a condition also shown by specimens taken as late as June 11.

This species possibly breeds earlier than *O. pallasi*, for very small young (length, 105 mm.) were taken some twenty miles southwest of Urga on May 18 and 19, 1922, and others May 21 near Tze Tzen Wang.

Another, equally small, was caught at Loh, July 7, and is interesting in having a well-developed first digit on the right hind foot, but whether on the other hind foot, is not certain, as it is injured.

A December specimen from Kweihwacheng, Shansi, should probably represent *O. bedfordi* Thomas from Ningwufu and Kolanchow, Shansi, and Yeninfu, Shensi, which is said to differ in its rather larger size and larger bullæ. The measurements given, however, are not greater than those shown by specimens of *O. dauurica* from localities in northern Mongolia. Indeed, some of the latter have even larger bullæ. The Kweihwacheng specimen, though not full grown, appears identical in measurements with Mongolian examples. In its full winter coat, it is a uniform pale sandy buff, with paler post-auricular patches; below white, with a buffy collar which is prolonged as a narrow median buffy line along the ventral region.

***Ochotona pallasi* (Gray)**

*Lagomys pallasi* GRAY, 1867, Ann. Mag. Nat. Hist., (3) XX, p. 220.

A large sandy-buff (summer) species, with gray belly washed with buff. In the skull the incisive and palatal vacuities are separate.

A series of some fifty specimens was secured in 1922, from localities in the Gobi Desert, Mongolia: Gun Burte, Ussuk, Artsa Bogdo, and 40 miles southwest of Tze Tzen Wang. An adult from the last locality was still in very worn winter pelage on June 1, of a nearly uniform sandy gray above; the feet above and a tuft at the anterior base of the ear pale buffy; rump slightly more ochraceous; throat and middle of belly pale ochraceous. A second adult from the same locality, May 31, is similar but small patches of the ochraceous summer pelage are coming in on nose, base of ears, patch below ears and in the middle of back. Others from Gun Burte, June 21, have new ochraceous hair on nose, forehead, cheeks and a "whisker" patch of upwardly directed hairs below the ear, and still others taken at the same time and place are slightly farther advanced, the new pelage extending from nose to shoulders, and across the posterior part of the back. In somewhat younger (and more vigorous) animals, also taken June 21, the change is complete, the entire dorsal surfaces sandy, with a bright ochraceous tone, clearest on head, neck and rump, the feet paler; belly hairs slaty with whitish tips and a wash of ochraceous across the throat and medially on the belly. About a centimeter below the ear is a small patch of close, upwardly directed hairs, of contrastingly rufous color.

Several small young were taken as early as May 31 and June 1, forty miles southwest of Tze Tzen Wang, and others of about the same size June 21 at Gun Burte, June 25 at Ussuk, and July 11-24 at Artsa Bogdo.

A ready means of distinguishing this from *O. dauurica* is through the naked black pads, clearly visible at the ends of the toes in the present species; also, the hind claws are shorter.

***Ochotona cansa morosa* Thomas**

*Ochotona cansa morosa* THOMAS, 1912, Ann. Mag. Nat. Hist., (8) X, p. 403.

A dark brown race, having a plentiful admixture of black with ochraceous-tipped hairs. Feet with dark metapodial areas and pale buffy digits. Below, the hairs are white-tipped, the median area, or all but a lateral stripe, washed with ochraceous. The blue-gray bases of the hairs everywhere show through. Soles of hind feet dark brown.

Five skins from Tai Pai Shan, Tsing-ling Mts., at 10,000 feet, are nearly topotypes of this subspecies. From the same region Thomas has described a similar but grayer and white-bellied species, *O. syrinx*, which, however, was not met with by the Asiatic Expeditions.

***Ochotona forresti* Thomas**

*Ochotona forresti* THOMAS, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 662.

A dark brown species allied to *O. tibetana* but larger and more ochraceous in color.

The type, from 13,000 feet, on the northwest flank of the Lichiang range, Yunnan, is described as larger than any other known member of the *tibetana* group (length 185 mm.). The collection contains a single immature female from 12,000 feet on the same range.

***Caprolagus sinensis sinensis* (Gray)**

*Lepus sinensis* GRAY, 1833-34, 'Illustrations of Indian Zool.,' II, Pl. xx.

This is the common rabbit of South China, of a bright ochraceous buff, much darkened above by long black hairs, and having a blackish patch on the face below the eye; chin and throat buff, mid-ventral area white.

So different is this rabbit in its external and cranial characters from the more typical members of the genus *Lepus*, that it can no longer be regarded as congeneric with them. In its short ears, short hind foot, short, nearly concolorous tail, and relatively harsh pelage it is obviously



peculiar, and the characters of the skull further emphasize its distinctness. In all these points it shows much agreement with *Caprolagus hispidus* of Nepal and Assam, and I am therefore transferring it to that genus. As in *Caprolagus*, the supraorbital processes are less developed than in *Lepus*, lack the deep notch anteriorly, and their tips do not extend back to the braincase. The postorbital constriction is narrower as well, so that when viewed from above much more of the orbit is visible, whereas in *Lepus*, the large supraorbital process overhangs and hides the greater part of the orbit. In two out of five specimens the sutures of the interparietal bone are distinct all around, but in the others its posterior outlines are obliterated. The bone itself is very narrow. The jugal bone, instead of having its edges raised to form a wide external gutter as in *Lepus*, is flat on its outer surface, with the usual deep excavation near the anterior end. Other obvious differences are the generally heavier nature of the bones of the skull, the narrower opening of the posterior nares, and the smaller bullæ. The teeth agree with those of *Caprolagus* in the heavier form of the incisors with their simple groove (in the upper anterior pair) which, however, is deeper and more filled with cement in *C. hispidus* than in *C. sinensis*. The first upper premolar has three deep subequal re-entrant folds of enamel on its anterior face, whereas in *Lepus* the middle loop is deepest, the two others shallower. In *C. hispidus* the incisive foramina appear to be shorter and narrower than in *C. sinensis*, with the palatal bridge relatively longer, but these differences may be regarded as specific rather than generic.

The name *Lepus sinensis* first appeared on Gray's colored plate, said to have been drawn from a specimen sent by Reeves to the British Museum. As noted by Thomas in another connection, Reeves' mammals came from southeastern China, "more or less in the region of Canton," which may therefore be regarded as the type locality. It ranges northward along the coast apparently at least to the vicinity of Shanghai. The specimens secured by the Asiatic Expeditions are from Futsing and Yenping in Fukien Province, and Tung-lu, Chekiang. In the mountains of northwestern Fukien it is represented by the following subspecies.

***Caprolagus sinensis flaviventris*, new subspecies**

TYPE.—Sub-adult female, skin and skull, No. 84500, American Museum of Natural History, from Chunganhsien, Fukien Province, China. August 1, 1926. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Like the typical form but darker, the ochraceous tints deeper and the entire underparts ochraceous buff instead of being pure white mid-ventrally.

General color above a mixture of ochraceous buff and black. The longer hairs are of two kinds: those having a dark blackish base then a broad ochraceous band and a fine black tip; while mixed with these are hairs entirely black, which predominate over the back and rump, and become less numerous on the sides. Head, proëctote and tail above, dark mixed black and ochraceous like the back; sides of the head, especially below the eyes, black, only slightly mixed with ochraceous; an ill-defined pale buffy eye-ring. Neck patch clear ochraceous rufous. Outer margin of ears buff, their metentote and metectote more ochraceous. Fore feet and limbs above ochraceous rufous. Hind feet and entire underparts from chin to lower side of tail clear ochraceous, the bases of the belly hairs gray. A few black hairs are present on the lower throat.

SKULL.—Apparently this is not different from that of the typical race.

MEASUREMENTS.—In the type, the ear from meatus measures 62 mm., the hind foot 88, the tail 55. In a larger, male specimen the hind foot is 98 mm., the ear about 60. The skull of the type measures as follows (with the corresponding measurements of a larger, more mature female of *C. s. sinensis* from Tungh, Chekiang, No. 45338, in parentheses): greatest length, 77 (84) mm.; basal length, 60.5 (65.5); palatal length, 30 (33); incisive foramina, 18.5 (19.5); nasals, median length, 26 (27); zygomatic width, 37 (37.5); interorbital width, 17 (17); postorbital constriction, 11.5 (11); width of brain-case, 24.5 (26.5); interpterygoid width, 6.8 (6.8); length of bulla from ventral aspect, 9.5 (10); diastema, 19 (20); upper cheek teeth, 14.5 (15.6); lower cheek teeth, 15.5 (16).

Five specimens, including two very young ones, from Chungansien, near the northwest border of Fukien Province, all agree in the uniform ochraceous coloring of the under side, instead of being pure white mid-ventrally from the chest to vent. Mr. Clifford H. Pope who secured this series writes that the altitude here is 4000 to 5000 feet; "the mountains are forested and wild and probably reach an altitude of 7000 feet."

A narrow white mark is present on the forehead of the young and some of the adults.

#### *Lepus tolai tolai* Pallas

*Lepus tolai* PALLAS, 1778, 'Nov. Spec. Quad. e Glirium Ord.,' p. 17.

The nomenclature of the black-tailed hares of central and eastern Asia is still much in need of revision. The first applicable name is that of Pallas who in 1778 described *Lepus tolai* which lives "in deserto magno Gobëensi ubique ad Tybetum usque." In 1894 Thomas described *L. swinhoei* from Chefoo, Shantung Province, China, and other names have since been given to similar hares from that country, though seemingly the differences are slight. In 1907 Satunin gave new names to various Asiatic hares on the basis of small color characters, and with few comparative notes. In this group, the ear from crown is slightly shorter than the hind foot (with claw), there is a pale eye stripe and ring, the

tail is black above and pure white below to the roots, and the sides of the body in the winter pelage have a number of very long white-tipped bristles projecting far beyond the general surface of the pelage. Of the 58 specimens of this type collected by the Asiatic Expeditions of The American Museum of Natural History, as well as in a series in the Museum of Comparative Zoölogy, those from the Gobi Desert are practically all in their summer coat while those from China are in full winter pelage so that strictly comparable specimens are few. It is evident, however, that the hare of the Gobi Desert is paler in winter coat than that of North China, with more prominent gray rump, though within narrow limits there is considerable variation. Satunin regarded specimens from Transbaikalia as typical of *L. tolai* and describes the Gobi Desert hare as a distinct species, *L. gobicus*, but the differences noted are very slight, and it seems unlikely that the hares from Selenga River (which he assumes as the type locality of *L. tolai*) are very different from those inhabiting the northern Gobi, even if it were possible to ignore Pallas's statement that the Gobi Desert is the type region. For the present then, the pale, gray-rumped hare of the Gobi Desert may be considered as *L. tolai*, of which *L. gobicus* is a synonym. The species is represented in the collections of the Asiatic Expeditions by specimens from thirty miles south of Ude, thirty miles south of Urga, from Erhlien, Tsagan Nor, Ussuk, Artsa Bogdo, and Ula Usu, Mongolia.

***Lepus tolai swinhoei* Thomas**

*Lepus swinhoei* THOMAS, 1894, Ann. Mag. Nat. Hist., (6) XIII, p. 364.

A brighter colored, more buffy race, with slightly longer nasals than typical *L. tolai*.

More than thirty years ago Thomas pointed out the characters distinguishing the Chefoo Hare from the grayer form of the Gobi Desert, but although the two have since been regarded as distinct species, there seems now no doubt of their closer relationship, and I have therefore regarded the former as a subspecies of the latter. In winter pelage Swinhoe's Hare is mixed buffy and black above, with a number of long white-tipped hairs projecting beyond the rest of the pelage on the sides. The summer coat is shorter and lacks these longer hairs.

A number of specimens from the Peking region secured by the Asiatic Expeditions represent this race. Others from Shansi are obviously less yellow in winter pelage with a very pinkish tint, while a few from the Ichang region in the Yangtze Valley are richer in tone becoming almost rusty. Since names are available for these geographic variants, they are

recognized as below. Typical *swinhoei* was described from the Shantung peninsula, and the Peking specimens are assumed to be the same. In winter coat they are pale yellowish above, but some are hardly distinguishable from the next race. A large proportion (six of 13 skins) show more or less mixture of buffy-tipped hairs with the black of the tail, a character used by Matschie as the basis of his *Lepus stegmanni*, shown by Thomas to be a synonym of *L. swinhoei*.

***Lepus tolai filchneri* Matschie**

*Lepus filchneri* MATSCHIE, 1908, 'Exped. Filchner nach China und Tibet,' X, pt. 1, pp. 217-219.

*Lepus swinhoei brevinasus* J. A. ALLEN, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 427.

*Lepus swinhoei sowerbyæ* HOLLISTER, 1912, Proc. Biol. Soc. Washington, XXV, p. 182.

The series of black-tailed hares collected by the Asiatic Expeditions includes ten from Kweihwacheng, northern Shansi, in freshly assumed winter coat (October 22-24), and four (one in winter coat) from the Tai Pei Shan region of southern Shensi. All are quite similar in color and undoubtedly represent *L. filchneri* described by Matschie from Hingan-fu, southern Shensi, with the description of which they quite agree. They show an average difference in coloring that separates them from the grayer form of the Gobi Desert, true *tolai*, but their similarity to the Chefoo Hare, *L. t. swinhoei*, is rather closer. They may usually be distinguished, however, by the decidedly pinker, less yellowish, tint of the back and sides, and by the buffier tint of the back and exposed inner portion of the ear including its fringe of longer hairs at the outer edge, portions which in *swinhoei*, as represented by specimens from Peking, tend to be white or whitish, even forming a contrasting white edge above and below. In addition there is less tendency to a mixture of buffy hairs with the black of the tail, and the nasal bones of the skull average slightly shorter. A winter specimen from Tai Pei Shan is quite the same as the Kweihwacheng series. Three others from near Sianfu, Shensi, are in summer pelage which is much shorter, and uniformly pale yellowish (buff) grizzled with black above, clear buff on the sides and limbs, and without the long whitish bristles of the winter coat. There is no doubt that Hollister's *Lepus swinhoei sowerbyæ* (1912) from northern Shansi is the same. He compared it with the pale race *subluteus* of the Ordos Desert and described it as having a grayer rump, lighter pinkish-buff chest-band and more white on the under side of the fore legs, char-

acters which prove to be rather variable when a series is examined. It is possible that *Lepus gansuicus* Satunin (1907) from Kansu may prove indistinguishable, in which case this name has precedence.

***Lepus tolai aurigineus* Hollister**

*Lepus aurigineus* HOLLISTER, 1912, Proc. Biol. Soc. Washington, XXV, p. 181.

In the southern part of its range in China the black-tailed hare responds to the warmer and moister climate by a marked increase in the brightness of its yellowish tints. In winter pelage the entire upper parts are bright ochraceous much mixed with black; the spot before the eye, the eye-ring, inside of ears and their borders are rich ochraceous, the fore legs and chest-band pale cinnamon, the sides clear buff. Hollister's *Lepus aurigineus* is evidently this form, which may now be considered a race of *L. tolai*. The type locality is Kiu Kiang, northern Kiang-si.

Through the kindness of Mr. G. S. Miller, Jr., U. S. National Museum, I have been able to compare the type with other Chinese specimens, and it is unquestionably a member of the *tolai* group. Though nearly full-grown it is nevertheless immature as indicated by the skull, while the skin itself has the appearance of having been prepared from an alcoholic specimen. It lacks the tail and is obviously somewhat faded.

A series of winter skins, collected by the late W. R. Zappey in western Hupeh Province for the Museum of Comparative Zoölogy, is referred to this race while two others from Wanhhsien on the eastern border of Szechwan, secured by the Third Asiatic Expedition of The American Museum of Natural History, are nearly similar, though one is less ochraceous than the other. Probably these two are best regarded as intergrades between the two subspecies, *filchneri* and *aurigineus*.

***Lepus comus*, new species**

TYPE.—Adult female, skin and skull, No. 43174, American Museum of Natural History, from Teng-yueh, Yunnan Province, China, 5,500 feet altitude. April 19, 1917. R. C. Andrews and E. Heller.

DESCRIPTION.—Related to *L. nigricollis* but with longer hind foot, color darker, less buffy, the nape dull brown, the tail beneath and bases of belly-hairs pale slaty gray.

Head, above, dull ochraceous buff, slightly mixed with black; a whitish band from the muzzle to the base of the ear, including both eye-lids; cheeks grizzled buffy, gray, and black. Nape patch dull russet with many pale-tipped hairs. Ears dark, the proëctote grizzled buffy and black, the anterior edge with a fringe of longer grayish hairs on its basal three-fourths, the posterior edge clearer white; tip of ear, both its edge and posterior terminal half of metectote, dark brown; base of metectote sparsely covered with short grayish hairs. Inside of ears with very few pale hairs, but an ill-

defined dark brown submarginal border basally. The back is a very dark mixture of buffy and blackish in about equal proportions. The individual hairs are about 32 mm. long, grayish at base, then ringed with ochraceous, then with black, succeeded by a buffy tip. On the rump these rings become very much paler and the tips whitish, resulting in a grizzled gray appearance. The flanks, fore legs from elbow, and outer side of hind legs and backs of hind feet are clear ochraceous buff. The tail is peculiar in being grizzled blackish-brown and whitish above like the rump, and gray faintly tinged with buffy below, the basal portion of all the hairs pale slaty gray instead of pure white. The throat band is clear ochraceous with a sprinkling of longer white-tipped hairs. Chin, inner sides of legs to elbow and heel white; the chest and belly white with blue-gray bases except anteriorly where the hairs are pure white throughout their length.

**SKULL.**—In general structure the skull is very different from that of the black-tailed hares of the *L. tolai* group, but closely resembles that of *L. nigricollis*. In the former the anterior edge of the orbit forms a slight wing standing out at right angles to the long axis of the skull, but in the latter the sides of the rostrum come straight back to this edge so that there is little if any projecting rim and the base of the rostrum appears much broader in proportion. The supra orbital processes are more slender with their anterior arm marked off by a short narrow slit in *L. nigricollis* and *L. comus* but in the *tolai* group are widely notched in front, and in addition are turned slightly upward, so that in profile they stand up above the general contour of the skull. In *L. comus* and *L. nigricollis* the profile is evenly convex whereas in *L. tolai* the nasals are less depressed and the dorsal outline of the braincase is more sharply bent downward. The meatus of the ear is also directed more posteriorly in the two first. In ventral view the inner margin of the bulla is broader and its foramen more prominent. The groove on the front face of the incisors is continued backward with two short lateral arms, forming a Y. The portion internal to this groove projects forward beyond the level of the outer part of the tooth.

**MEASUREMENTS.**—The type measured: length, 480 mm.; tail, 95; hind foot with claws, 130; ear, 97. The skull of the type and an imperfect one of a second specimen from the same locality measure: greatest length, 95, —; basal length, 76, —; palatal length, 39.5, 37; diastema, 27.5, 25; nasals, greatest length, 41, 41; length of contact medially, 31, 31; greatest width, 24, 23.5; zygomatic width, 42.5, —; mastoid width, 30, —; width outside molars, 26, 26.5; outside lacrymals, 35.5, 32+; upper cheek teeth, 17.6, 17.4; lower cheek teeth, 18.2, 17.5; jaw, condyle to tip of bone at base of incisors, 70.5, 67.5.

The discovery of this hare is a matter of great interest, since it is closely allied by the characters of the skull to *L. nigricollis*, the black-necked hare of the Indian peninsula and Ceylon (subspecies *singhala*), but differs strikingly in color, especially in the dark back with its lack of bright buffy and the dull russet instead of black nape, the gray bases of the white hairs of the belly, and particularly in the tail which is pale slaty gray underneath. In its large size, notably of the hind foot, it differs further from *L. nigricollis*. The species *L. siamensis* and *L. peguensis* are much smaller and probably are more nearly related to *L. hainanus*. The skull of the type is peculiar in lacking all trace of the

small second upper incisors but they are present in a second specimen from the type locality. This latter and a young one taken May 10, and an imperfect skin from Lichiang, 8200 feet, agree in all essentials of coloring. A note by the collector states that the type contained two large embryos. Apparently these are the first hares to be recorded from western Yunnan although Wroughton (Journ. Bombay Nat. Hist. Soc., 1915, XXIII, p. 477) mentions that Major Harington secured some hares "beyond Bhamo," eastern Burma, which were "certainly not" *L. peguensis*, and may have been the species here described.

***Lepus hainanus* Swinhoe**

*Lepus hainanus* SWINHÖE, 1870, Proc. Zool. Soc. London, pp. 233, 639, Pl. XVIII, text-figs. 1-4.

A small hare with relatively short stiff pelage and dark coloring, a mixture of dull ochraceous and black above; a prominent white eye-ring, continued to muzzle; fore legs and throat-band bright ochraceous rufous, hind legs paler; chin, belly and under side of tail pure white to the roots. Foot about 85 mm., ear 75.

A series of these hares from Nodoa, Hainan, includes a number of partly grown young taken from January to July. Compared with the hares of North China and Mongolia this differs in several minor points, such as the narrowness of the posterior narial opening, the small size of the bullæ, and the peculiar form of the groove on the front face of the upper incisors. This last, instead of being a simple V-shaped groove with its apex posteriorly, is Y-shaped with the two diverging arms extending as re-entrants posteriorly, the whole filled with cement.





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PORCUPINES FROM CHINA<sup>1</sup>

BY GLOVER M. ALLEN

The Asiatic Expeditions under the direction of Dr. Roy Chapman Andrews have succeeded in assembling a splendid series of no less than forty porcupines from China, mammals which, on account of their size and the difficulty of capturing and preserving them, are likely to be neglected by collectors. Particular credit is due Mr. Clifford H. Pope who secured the greater part of the specimens. Two genera are represented, the brush-tailed porcupine, *Atherurus*, and the more specialized crested porcupine, currently referred to *Acanthion* although regarded by some as inseparable from *Hystrix*. Both genera are found in China in only the southern half of the country. Mr. Pope's series from the island of Hainan contains eleven old and young of *Acanthion* which prove to constitute a very distinct island form allied to that of the Chinese mainland.

***Atherurus macrourus stevensi* Thomas***Atherurus stevensi* THOMAS, 1925, Proc. Zool. Soc. London, p. 505.

A single male skin without skull from Wanh sien, eastern Szechwan, is apparently a considerable extension northward of the recorded range of the brush-tailed porcupine in China. It agrees with *A. stevensi* Thomas, lately described from Tonkin, in the possession of numerous white woolly hairs among the bases of the spines, particularly noticeable over the shoulders. In typical *A. macrourus* from Malacca these are said to be few and brownish. For the present this Chinese form may therefore be considered the same as that from the extreme southern edge of the country, and is probably best regarded as a northern subspecies of typical *macrourus* of Malacca and the Malay Peninsula.

***Atherurus macrourus hainanus* J. A. Allen***Atherurus hainanus* J. A. ALLEN, 1906, Bull. Amer. Mus. Nat. Hist., XXII, p. 470.

A series of seventeen skins, including a very small young one (April 13), was secured by Mr. Clifford Pope near Nodoa, Hainan, through a

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 78.

native hunter. These are very uniform in color, with the spines of the upper surfaces brown, becoming blackish on the back, intermixed with a few long white bristles over the rump. The sides are varied with whitish, each spine with a white tip and base, and brownish central ring. The lower side is soiled whitish. The small size as compared with typical *A. macrourus* is the chief characteristic difference.

***Acanthion subcristatus subcristatus* (Swinhoe)**

*Hystrix subcristata* SWINHÖE, 1870, Proc. Zool. Soc. London, p. 638.

The common porcupine of China and its near relatives differ externally from the crested porcupine of Europe and Africa in the less development of the long erectile dorsal bristles which in the former are confined to a short space on the median part of the neck, with shorter bristles between these and the area of long spikes on the back, whereas in the latter they form a continuous crest from between the eyes to the shoulders. In the skull these eastern members differ in the much less expansion of the nasal cavity, which in typical *Hystrix* is enormously inflated, with the nasals greatly broadened and extended posteriorly so as to encroach upon the frontals. Miller in 1912 ('Mamm. Western Europe,' p. 543) restricted the name *Hystrix* to the European and African species of this type, but more recently Lönnberg (1923, Arkiv f. Zool., XV, No. 18) has advocated that all the short-tailed porcupines be referred to this genus. He recognizes, however, that they may be divided into three groups, according to the method by which the bones surrounding the nasal chamber are modified in its enlargement; but until a comparative study of all the eastern species can be made, it seems permissible to retain the genus *Acanthion* for the Asiatic species with less modified skulls. In young specimens of the Chinese *Acanthion* a striking feature of the skull is the very large size of the interparietal which is pentagonal and with an area as great as the dorsal part of a parietal in a skull 55 mm. long. In an immature *Hystrix galeata* it is a very small triangular bone.

Swinhoe mentions having often heard of the porcupine at Swatow (Kwangtung Province) and at Foochow (Fukien Province), whence he secured a specimen that later became the type of his *Hystrix subcristata*. Lönnberg records specimens from Anhwei Province, while the Asiatic Expeditions, in addition to a series from Futsing, Fukien Province, obtained one at Wanhsien, eastern Szechwan, that is similar, and another from Lichiang, Yunnan Province. The last may eventually prove to represent *yunnanensis* Anderson, but the skull is missing. Thomas has shown (Journ. Bombay Nat. Hist. Soc., XXVIII, p. 432) that this name

is valid and applies to a porcupine with short nasals, perhaps representing a species distinct from *A. subcristatus* and closely related to *A. javanicus* of Java, in which the nasals are likewise short. That this type of porcupine was formerly more widespread in China is proved by the discovery of a fossil skull with similar short nasals in Honan Province. This has been named *Hystrix (Acanthion) lagrelii* by Lönnberg (1924, *Palæontologia Sinica*, Ser. C, I, fasc. 3). Although the geologic age of the specimen is not known, its state of preservation suggests that it is not very ancient.

In his list of the mammals of the island of Hainan, Swinhoe (1870, *Proc. Zool. Soc. London*, p. 233) further records the finding of a single porcupine quill "in the jungle at Nychow (S. Hainan)," thus establishing the occurrence of *Acanthion* on that island, but it has remained for Mr. Clifford H. Pope of the Third Asiatic Expedition to secure a fine series of skins and skulls from near Nodoa, which on comparison with the series obtained by the same collector in Fukien, are found to represent a well-marked race, here described.

***Acanthion subcristatus* pope, new subspecies**

*Hystrix hodgsoni* SWINHOE, 1870, *Proc. Zool. Soc. London*, p. 233 (not of Gray).

*Hystrix subcristata* SWINHOE, 1870, *Proc. Zool. Soc. London*, p. 638.

TYPE.—Adult male, skin and skull, No. 60048, American Museum of Natural History, from Nodoa, island of Hainan, China. January 9, 1923. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Similar to *A. subcristatus subcristatus* but smaller, with a lower and slenderer skull; the nuchal crest is slightly less developed, and the large spines on the back are more extensively dark with correspondingly shorter white tips.

The general color, as in the typical form, is dark blackish brown, with a white half collar or V-shaped mark on the throat formed by short white spines, and a short crest on the mid-line of the neck consisting of elongated slender bristles most of which are deep brown at the base and white on the distal two-thirds. This crest in a series of nine adults is of much shorter and darker bristles than in the Fukien series and in a few is almost altogether wanting. The elongated slender bristles of the lower back are in both forms white except at the extreme base, but the heavier spines have the dark middle portion more extensive so that the white tips are correspondingly much shorter (35 mm. against 50 on the average for the medium-length spines) and there is an almost total lack of long heavy spines that are white throughout. The tail with spines and capsular bristles is similar in both forms but the spines are darker in the Hainan porcupine.

SKULL.—The cranium is smaller and slightly more slender throughout than in typical *A. subcristatus*, with conspicuously less vertical depth. The dorsal profile is very evenly convex and there is no trace of a postorbital process. The nasals are long, pointed anteriorly, and at first relatively narrow, expanding laterally in their terminal (posterior) third. Their combined posterior border is convex backward, its median

point reaching the level of the middle of the orbito-temporal fossa. The median and lateral boundaries of the nasals first disappear through fusion with adjacent bones. The ascending branch of the intermaxillary is narrow, tapering dorsally and with a truncate posterior border. The median length of the combined interparietal and parietals equals or very slightly exceeds that of the frontals. The cheek teeth except for their less transverse width do not differ from those of the mainland animal.

MEASUREMENTS.—The flat skin of the type which is fully adult measures about 670 mm. from snout to end of capsular bristles of the tail; the latter is about 100 mm. long.

The skull measurements follow, with those of No. 60174, adult male, from Fusing, Fukien Province, in parenthesis after each. Greatest length, 135 (138+) mm.; basal length, 121.5 (129); palatal length, 72 (79); diastema, 33 (38); median length of nasals, 74.5 (79); zygomatic width, 65 (74.5); mastoid width, 46 (52); across outer edges of palate, 28 (29.5); upper cheek teeth, 30 (29); lower cheek teeth, 29 (29); mandible from condyle to anterior point of jaw, 85 (91); depth of cranium above *m*<sup>1</sup>, 57 (67).

The adults all agree in their small size and dark color as compared with Fukien specimens. The young ones, 165 and 190 mm. in length respectively, were both secured December 9, 1922. They are uniformly dark brown, except for a few long white quills and heavier white-tipped spines on the lower back, and a tuft of white hair at the anal region. There is no trace of white bristles on the nape nor are the bristles here elongated to form a crest.

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## NEW ASIATIC MAMMALS<sup>1</sup>

BY GLOVER M. ALLEN

In the course of identifying the small mammals collected by the Asiatic Expeditions of The American Museum of Natural History in recent years, the following new forms have been found, which seem worthy of description.

### **Soricidae**

#### ***Crociodura lar*, new species**

**TYPE.**—Male, skin only, No. 59940, American Museum of Natural History, from Tsagan Nor, Mongolia. August 3, 1922. Third Asiatic Expedition.

**DESCRIPTION.**—A very small, pale species, with relatively short tail.

Upper surface of body and tail a very pale grayish brown, about "wood brown" of Ridgway (1912), the hairs dark slaty at their bases, then minutely ringed with gray, and tipped with pale brown. The gray rings showing through give a minutely grizzled effect and heighten the pallor of the upper side. Under surface of snout and tail, the entire chin and the backs of fore and hind feet white to the roots of the hairs. The rest of the under side of the body has the hairs slaty gray at the base tipped with white, so that the entire belly looks dull white. The tail is well clothed with short hair forming a small pencil, and is rather sharply bicolor; it has the numerous scattered bristles projecting conspicuously throughout its length.

**SKULL.**—Unfortunately the skull cannot now be found.

**MEASUREMENTS.**—The collector's measurements are: head and body, 60 mm.; tail, 29; hind foot, 12; ear, 8.

The discovery of a species of this genus in the Gobi Desert far beyond its previously known northward range in this part of Asia is very interesting. That the species is rare there is evident from the fact that with much trapping no other specimens were secured. This individual was caught in one of the tents into which it came one night. Although the skull is not available for study, the species seems so distinct in its pale desert coloration, small size, and short tail, scarcely twice the length of the hind foot, that I have no hesitation in naming it.

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 80.

**Rhinolophidae*****Rhinolophus blythi parvus*, new subspecies**

**TYPE.**—Adult, skin and skull, No. 58465, American Museum of Natural History, from Nodoa, island of Hainan, China. December 8, 1922. Clifford H. Pope, collector; Third Asiatic Expedition.

**DESCRIPTION.**—Structurally like *R. b. szechwanus* of western China and *R. b. calidus* of southeastern China, but differing from both in its rich russet or darker brown coloring.

Color above in the red phase, nearly "russet" (Ridgway). The individual hairs over the back are pale ochraceous at their bases, deepening to a distinct russet tip about 2 mm. in length. Scattered among these are hairs with minute blackish tips, producing a darkening of the surface. On the sides of the head and on the neck, chest and mid-ventral area, the color is clearer, brighter russet; the throat is paler, pinkish buff. In the axillar area, ventrally, is a well-defined dusky area. Specimens in the brown phase are Mars brown, paling to the roots of the hairs, above; below, drab washed with chestnut at the sides.

**SKULL.**—The cochleæ are very large, nearly meeting in the midline so that the basioccipital is very much narrowed. There is a well-defined sagittal crest, branching anteriorly to form a ridge over each orbit, with a slight depression between. The first small upper premolar stands quite in the tooth row; while in the lower jaw the minute middle premolar of the type specimen stands in the row, but in other specimens may be partly external to it.

**MEASUREMENTS.**—In the type the forearm measures 36.3 mm.; third metacarpal, 27; fourth metacarpal, 28; fifth metacarpal, 27.6; tibia, 13.5; foot, 7.

The skull measures: greatest length, 16.5; basal length, 13.3; palatal length, 5.4; palatal bridge, 1.7; zygomatic width, 7.5; mastoid width, 7.7; width outside molars, 5.7; upper cheek teeth (canine to last molar), 5.7; lower cheek teeth (canine to last molar), 6.0.

Among the specimens secured, a bright, tawny phase is the more common, while a deep-brownish phase is also represented. In its brighter, more intense coloring it forms a marked contrast to the dull, gray-colored *R. b. szechwanus* in which the bases of the dorsal hairs are whitish, their tips drab, the belly drab. In *R. b. calidus* of eastern China the color becomes slightly more buffy but in this race from Hainan it is strikingly redder, even to the bases of the hairs. A series of over fifteen skins collected by Mr. Clifford H. Pope shows much uniformity of tint; but the dull-colored, grayish immature specimens are about as bright as adults of *R. b. calidus*.

In the dark or brownish phase this race resembles the two others mentioned, but is a much darker brown. The immature individuals of the series are similar, and it is possible that these brown adults are in reality not fully mature.

***Rhinolophus lanosus spurcus*, new subspecies**

TYPE.—Adult male, skin and skull, No. 58444, American Museum of Natural History, from Nodoa, island of Hainan, China. December 4, 1922. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—A large, woolly-haired species with the external proportions as in typical *R. lanosus* of Fukien, China, but the skull much larger and the fur more sooty brown.

Andersen described *R. lanosus* as a member of the *philippinensis* group, with the base of the central nose-leaf forming wing-like lateral expansions. The fur is long and woolly, somewhat wavy, of a dull chocolate-brown above and below, tipped minutely with gray, giving a slightly frosted effect. In *R. lanosus* from Fukien, the color is a slightly richer brown.

SKULL.—The skull is decidedly larger than that of *R. lanosus*. The supraorbital ridges in both meet to form a prominent sagittal crest and cut off anteriorly a triangular depression between the orbits. The parietal area shows a curious pitting of the surface of the bone. The upper small premolar is quite in the tooth row but the lower one is partly external, so that it separates the two larger premolars, whereas in the Fukien race it is smaller and more to the exterior, allowing the two large premolars to meet.

MEASUREMENTS.—No collector's measurements accompany the specimens. The forearm measures 70 and 71 mm. in the type and a second male respectively. Third metacarpal of type, 44.7 mm.; fourth metacarpal, 53.2; fifth metacarpal, 54.2; tibia, 36; foot, 18.

The skull measurements of the type follow and, in parenthesis after each, those of an adult male from Fukien: greatest length, occiput to front of canine, 31.3 (28.4); foramen magnum to front of canine, 25.2 (23.0); palatal notch to front of canine, 9.6 (9.2); zygomatic width, 15.5 (13.2); mastoid width, 13.5 (12.8); width across molars, 10.4 (10.3); palatal bridge, 5.0 (4.8); upper cheek teeth, 11.3 (10.7); lower cheek teeth, canine to back of last molar, 12.0 (11.1); mandible from condyle to base of incisors, 21.5 (20.0).

This large woolly-haired species was originally described from Fukien Province, China, whence a small series was later obtained by Dr. Roy Chapman Andrews and Rev. H. R. Caldwell. The skull measurements of the type of *R. lanosus* agree almost exactly with those of a male from Yenping, Fukien, and are thus considerably smaller than those of the Hainan specimens, although the external dimensions are practically the same. Mr. Clifford H. Pope, who secured these bats, writes that they are rare. The first one was found in a prospector's shaft in woods. This tunnel was about fifteen feet deep, slanting, and not completely dark. A second bat was started but not secured in another similar shaft. A third was taken in another tunnel in woods. In each case the solitary bat was the only inhabitant of the cave and hung from roots in the ceiling.

**Hipposideridae*****Cœlops sinicus*, new species**

TYPE.—Adult female, skin No. 84893, and skull No. 84388, American Museum of Natural History, from a cave two miles northeast of Wanhhsien, Szechwan, China. February 26, 1926. Collected by Walter Granger; Third Asiatic Expedition.

DESCRIPTION.—Related to *Cœlops frithii* Blyth but smaller with a different coloring, and without a space between lower outer incisor and canine.

The pelage is long, dense and woolly, about 11 mm. in length on the back. The hairs, instead of being "shining brown" above and below, with pale bases, as described in *C. frithii* from Bengal, are blackish for the proximal two-thirds, with the terminal third indistinctly brown, nearly "sepia" of Ridgway (1912). The lower surfaces are similarly blackish at the bases of the hairs, then minutely brownish, tipped with gray, producing an indistinctly tricolor effect on close inspection. The membranes and the large translucent ears are smoke-gray.

In the structure of its remarkable nose-leaves, the specimen agrees closely with *C. frithii* as figured by Dobson. The horseshoe and the median erect process posterior to the nostrils are thickly clothed with short stiff hairs, while longer hairs arising from the sides of the nose-leaves behind the horseshoe form a well-defined fringe. On each side are six longer, shining hairs, probably sensory, one from back of the anterior edge of the main leaf of the horseshoe, three along its lateral edge, and two erect hairs from the face of the raised ridge behind the nostrils.

The wing in this genus is peculiar in the shortness of the third finger and the length of the fifth. The thumb has a very long metacarpal and short phalanx (7: 1.6 mm.), the former wholly involved in the propatagium; the second digit has no phalanges, and its metacarpal is minutely longer than the combined metacarpal and first phalanx of the third digit. The latter is the longest digit due to the great length of its second phalanx, for its metacarpal and first phalanx are less than those of the fourth or the fifth digits. The fourth finger is shorter than the third or fifth. The wing membrane arises from the metatarsus at the base of the toes. The calcaneum is well developed, as long as the toes, and serves to spread the interfemoral membrane which is deeply emarginate to within about 6 mm. of the body in the dried skin, and has its free border thinly fringed with short hairs.

SKULL.—The skull, compared with that of *Hipposideros gentilis*, is remarkable for its delicate structure, with a nearly globular brain-case and very narrow inter-orbital constriction, to which the sharp sagittal crest is confined. The frontal shield is nearly flat, its dorsal surface inclined at a sharp angle to the plane of the tooth row, and its anterior swellings but little raised above the general level on each side. The peculiar prolongation of the premaxillæ and maxillæ combine to give the skull a profile that tapers nearly to a point in front.

The upper canine is noticeably compressed, with a prominent secondary cusp, projecting about half-way on the posterior cutting edge. The anterior small upper premolar is distinctly crowded to the outer side of the tooth row, but the second premolar does not quite reach the base of the canine. In the lower jaw the outer incisor abuts closely against the canine instead of being separated by a space as in *C. frithii*, and in height barely exceeds the cingulum of the canine. The anterior lower premolar is slightly to the outer side of the tooth row. All the lower cheek teeth are much compressed and blade-like.



MEASUREMENTS.—The collector's measurements are: head and body, about 38 mm.; ear, 16; spread of wings, 232. The forearm measures 35.5 mm.; thumb, metacarpal, 7; phalanx, 1.6; second finger, metacarpal, 35 (the bone is slightly bowed in the skin); third finger, metacarpal, 26.3; first phalanx, 7; second phalanx (across the chord of the bone as bent in drying), 22; fourth finger, metacarpal, 28.6; first phalanx, 9.0; second phalanx, 10.2; fifth finger, metacarpal, 30.5; first phalanx, 10.1; second phalanx, 12.0; tibia, 16.4; hind foot, 8; calcar, 5.

Skull: greatest length, 17.0; basal length, 13.5; condyle to front of canine, 15.1; palatal length, 6.2; median length of premaxillaries, 4.0; zygomatic width, 7.8; mastoid width, 8.2; interorbital constriction, 1.8; width of frontal shield, 3.9; width outside molars, 5.8; front of canine to back of last upper molar, 6.4; lower tooth row, incisor to back of last molar, 6.8.

Of this rare genus there is at present recognized but two species, *Caelops frithii*, of Bengal and Java and *C. robinsoni* of Pahang, a slightly smaller replica of it. The single individual on which the new species is based extends the known range of the genus well into China. While its relationship to the Indian species may eventually prove to be closer than indicated, its smaller size and different style of coloring seem to proclaim its specific distinctness. The highly modified upper canines with their strong forward projection, prominent secondary cusp, and compressed cutting edge, the deeply emarginate tail membrane, the peculiar nose-leaves and enlarged ears may indicate some unusual feeding habit. In contrast to its relatives *Hipposideros*, *Caelops* seems to be solitary in habits. The specimen described was secured by Mr. Walter Granger from a "warm-air" cave, in which it was evidently hibernating.



# AMERICAN MUSEUM NOVITATES

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## MUSTELIDS FROM THE ASIATIC EXPEDITIONS<sup>1</sup>

BY GLOVER M. ALLEN

On bringing together the mustelids, collected by the Asiatic Expeditions, they are found to comprise over one hundred and forty skins, representing various localities in China (chiefly in Yunnan, Szechwan, and Fukien Provinces) and a few in Mongolia. A critical study of these has entailed a careful consideration of a number of names based on eastern Asiatic specimens, with the result that in many cases it has been possible to arrive at fairly satisfactory conclusions as to their validity. A few wide-ranging species have closely allied representatives in northern India and in parts of China, as *Mustela sibirica*, *M. kathiah*, and *Arcionyx collaris*, so that it will be necessary eventually to show the relationship of sundry Chinese forms to Himalayan species by the use of trinomials. A list of the species secured, with brief remarks, follows. Only one new form is described, a northern race of the lesser ferret-badger, a species hitherto known only from Indo-China.

### *Chararronia flavigula flavigula* (Boddaert)

*Mustela flavigula* BODDAERT, 1785, 'Elench. Anim.,' p. 88.

Size of a house cat, with long tail and short legs; head from muzzle to base of ears, the nape, forearms, fore feet, hind legs and tail brownish black; body above golden on shoulders, passing into brown and black on rump; chin to ears white, throat yellow, belly brownish gray; in summer darker above and below on body.

The series of this long-tailed marten includes four from the Namting River, Yunnan, near the Burma border, and one from Lichiang in the same province, that undoubtedly represent the typical form, whose range extends southeastward at least to Siam, for Thomas has lately relegated the name *indochinensis*, based on the Siamese animal, to the synonymy of *flavigula*. There is more or less individual variation in color among these specimens and the matter is further complicated by the fact that summer skins are darker than winter specimens, apparently

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 89.

with an increase in the golden area of the back and a darkening of the belly. It was a dark-bellied skin (May 6), no doubt wholly or partly in summer fur, that served Bonhote as the type of his *Mustela f. kuatunensis* from Fukien, but this supposed race also proves to be untenable, for winter skins from this province are quite as pale-bellied as those from Yunnan taken in February. Indeed, the yellow of the throat seems a very little paler in winter skins from Fukien as compared with the latter, but this difference is so very slight and uncorrelated with other characters, that it seems better to regard the South China form as typical *flavigula*.

A single skin from the Tsingling Range, Shensi, is a trifle paler yellow on the throat and lighter brownish gray above than any of the more southern winter skins but this variation may be individual, or possibly approaches the winter condition of *C. f. borealis* (Radde) of Amur Land, a race that seems to be slightly paler and with a very little larger skull. To this subspecies Jacobi referred the skins from Min Valley region, Szechwan, brought back by the Weigold Expedition and showed that Hilzheimer's *Mustela f. szetschuensis* is not distinguishable. Additional material from northwestern Szechwan, however, shows no important differences from the Yunnan series and is probably best regarded as *C. f. flavigula*. The range of *C. f. borealis* is probably cut off from that of the Chinese animal by the intervention of the Gobi Desert, except in north-eastern China and Manchuria.

#### *Mustela larvata tiarata* Hollister

*Mustela tiarata* HOLLISTER, 1913, Proc. Biol. Soc. Washington, XXVI, p. 20.

A large weasel, face and forehead dark brown, neck, back, and basal two-thirds of tail light fulvous, with short white underfur, the back darkened by long black-tipped hairs; throat, chest, fore and hind legs, and tip of tail blackish to blackish brown; sides of belly buff.

The weasel described by Hollister from Kansu (150 miles east of Lanchow) as *Mustela tiarata* is undoubtedly a very close relative of *M. larvata* of southern Tibet, from which it differs mainly in having the blackish facial mask continuous with the dark brown of the forehead instead of being separated by a distinct white area, and in having the terminal part only of the tail black instead of its entire length. Apparently Hollister's *M. lineiventer* from the Little Altai is a paler race with the facial mask distinct, while the animal described by Kastchenko from northwestern Mongolia as *michnoi*, is, as Hollister suggests, probably a race of *eversmanni* rather than of *larvata*, so far as may be judged from the

description. The latter is at once separated from *eversmanni* by its larger size, its tail longer in proportion, with a shorter black tip, and by its more yellowish ground color. In Hollister's description of *M. tiarata* the length of the foot is given as 93 mm., evidently a misprint for 63; also the tail of the type is said to have its terminal two-thirds black.

The Asiatic Expeditions secured three skins, from a locality eighty miles southeast of Urga, that conform closely with the description of *tiarata* except that the black tail-tip varies in length in each, from nearly one-half to a third, and even a quarter of the length of the tail. A fourth skin, from Paotou, Shansi, taken in spring is apparently paler on the body and with the forehead and crown as well as the sides of the face white instead of brown, and the nape nearly clear white with a yellow wash, indicating a seasonal difference in the coloring of the head and body. This weasel, like our black-footed ferret, frequents the colonies of marmots and ground squirrels on which it preys.

***Mustela sibirica fontanieri* (A. Milne-Edwards)**

*Putorius fontanieri* A. MILNE-EDWARDS, 1868-74, 'Recherches Hist. Nat. des Mamm.,' p. 205, Pl. LXI, fig. 1.

Weasel-like, with a long rather bushy tail, three-fifths the length of head and body; color uniform pale fulvous, slightly paler below; forehead brown, chin white, with often white marks on throat.

A careful comparison of Milne-Edwards's description and figure of *Putorius fontanieri*, based on a skin without skull from Peking, leaves no doubt that this animal is a representative of the yellow mink of Siberia and China. The description applies well to a female in pale winter pelage, and the dimensions taken from a skin are nearly identical with those of a female from Shansi. The yellow mink of eastern China has been currently referred to *M. sibirica* of Pallas, whose specimens came from the forests of Siberia, "voisines de l'Enisséi," but it seems unlikely that it is subspecifically the same as the more northern animal, especially in view of Radde's statement (1862, 'Reise,' I, p. 45) that specimens from the Amur region are larger and darker than those of the Baikal district. Until topotypes of *sibirica* are available for comparison therefore, Milne-Edwards's name may be adopted for the very pale-yellow form of the dry area of North China. In fresh winter pelage, the body is very pale, about "pinkish cinnamon" (Ridgway, 1912) above, paling to "cinnamon-buff" below, the tail somewhat more intensely colored, about "orange-cinnamon" (specimen from Fengsiangfu, Shensi, November 23), while late-winter specimens are even paler. The collections include

skins from Chimo (Shantung Province), Kwei-huacheng (Shansi Province), and Fengsiangfu (Shensi Province). There are also two adult males in the Museum of Comparative Zoölogy from near Taiyuanfu, Shansi.

***Mustela sibirica davidana* (A. Milne-Edwards)**

*Putorius davidanus* A. MILNE-EDWARDS, 1870, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, Bull., p. 92.

The yellow mink of southeastern China is much more intensely colored than that of northern China, almost "ochraceous-orange" (Ridgway, 1912) in fresh winter pelage, and tail not differing from the back. Summer specimens are darker, almost "ochraceous-tawny." Milne-Edwards's name *davidana*, based on a female from Kiang-si Province, is available for this form, the range of which extends from Shanghai west nearly to the borders of Szechwan and south in Fukien Province to Amoy, where Swinhoe mentions it as frequenting the walls of houses in pursuit of rats. The collections of the Asiatic Expeditions include skins from Foochow and Futsing (Fukien Province) and Ching River (Hupeh Province), while the Museum of Comparative Zoölogy has skins from Soochow (Kiang-su Province) and Ichang (Hupeh Province).

***Mustela sibirica moupinensis* (A. Milne-Edwards)**

*Putorius moupinensis* A. MILNE-EDWARDS, 1870, Nouv. Arch. Mus. d'Hist. Nat., Paris, VII, Bull., p. 92.

In the highlands of western China this species is represented by a much darker form having a contrastingly dark tail-tip. The brownish of the forehead extends back along the median part of the back, which in the other races mentioned is pale. The dark tip to the tail is present in all the skins examined, which includes six from Wanh sien, two from Tachiao, and one from Washan, in Szechwan, and one each from Talifu and Lichiang in Yunnan. The last locality is at an altitude of 12,000 feet.

Milne-Edwards, in describing these forms, gave them all specific status and apparently did not recognize the fact that females are considerably smaller than males. The westward range of this race probably is continuous with that of the smaller Nepalese *sub-hemachalana*, which may eventually prove also to be a subspecies of *M. sibirica*. Thomas indicates further that his *M. hamptoni* from Mt. Imaw Bum, northern Burma, is closely related to *moupinensis*, if not identical with it.

***Mustela kathiah* Hodgson**

*Mustela (Putorius) kathiah* HODGSON, 1835, Journ. Asiatic Soc. Bengal, IV, p. 702.

A weasel with tail slightly more than one-half the length of head and body; dorsal surfaces and tail all around uniform dark brown; lips and chin white; throat to wrists and ankles bright yellow, sharply delimited at sides.

A series of eleven weasels from Yenping and Futsing, Fukien Province, evidently represents Matschie's *Arctogale melli*, described from the adjoining province of Kwangtung, but I cannot see that they differ in any way from *M. kathiah*, of Nepal, to which the yellow-bellied weasel of Szechwan is currently referred. A single immature specimen from Lichiang, Yunnan Province, 9000 feet, is quite the same, so that, as in the case of *Charronia flavigula*, this weasel seems to have a wide range from northern India across southern China, without important change in color or size. There seems to be no doubt that Milne-Edwards's *Putorius astutus*, based on a weasel of this group from Moupin, Szechwan, is identical with the species here considered. He mentions that its fore feet are white on their upper surface, but this is not true of the Yunnan specimen, nor apparently of Nepalese specimens, though Hodgson mentions one from western India that had partly whitish feet. Matschie makes the wholly dark feet of his Kwantung specimen the chief distinctive character of *Arctogale melli*, but this is probably a matter that may vary individually. Yet none of the Fukien series has any white on the feet. Trouessart, describing a skin from Fukien, collected in 1874 by David, likewise states that the feet are dark like the back, while of three others from Ta-t sien-lu, Szechwan, supposed to be winter specimens, two have white toes and the third only "un peu de jaune" on the external side of the feet. Thus, while Szechwan specimens may or may not have white feet, it seems that those from Nepal, Yunnan, and Fukien do not so far as available evidence goes. Farther north, however, white on the feet is apparently the usual condition.

As to seasonal variation, the Fukien series is about equally divided between summer and winter skins, yet there is very little difference between those of July and those of December. The latter are, however, a very little paler above, more buffy, especially the underfur. The intensity of the yellow on the lower side varies individually from buff to deep ochraceous.

***Mustela pygmaea* (J. A. Allen)**

*Putorius (Arctogale) pygmaeus* J. A. ALLEN, 1903, Bull. Amer. Mus. Nat. Hist., XIX, p. 176.

Very small, tail about as long as hind foot; above, including tail,

brown; below white, including upper lip, fore feet (except center of backs of hands), the inner side of hind legs, and terminal half of hind foot.

Three summer skins taken in the vicinity of Urga, Mongolia, agree perfectly with the original description of this species, the type of which came from Gichiga, on the Okhotsk Sea, Siberia. One, a male, is from 15 miles north of Urga, the second is from 45 miles northeast of that city, while the third, a female, is without precise locality. This, is therefore, a considerable extension of the known range to the southwestward. Kuroda, in 1921, announced the discovery of a weasel of this type from northern Hondo, Japan, and named it *Mustela rixosa namiyei*. The female of the three Mongolian specimens has four small brown spots medially on the chest. One, a male, measured: total length, 177 mm.; tail, 20; hind foot, 24; ear, 16; the female, total length, 158; tail, 17; hind foot [? 20]; ear, 10. No doubt the relationship of this weasel to the American *M. rixosa* is very close.

#### HELICTIS Gray

##### Ferret-badgers

The ferret-badgers are distinguished externally by their somewhat weasel-like form, though they are less slender, their strong fore claws, greatly developed cartilaginous snout, and their color which is brownish gray above, more or less hoary, white below, and with white facial markings on forehead, cheeks, and ears, often with more or less of a white median line extending from the nape spot to the shoulders. They are of special interest since the several species of eastern Asia are very much alike externally but are very different in cranial characters. Thomas (1922) has lately summarized these points and recognizes three genera for the Indian, Chinese, and North Bornean ferret-badgers, but in view of the quantitative nature of the characters it may be better to regard these divisions as of subgeneric value only, for the species are obviously nearly allied. The Indian *Helictis personata* represents then the subgenus *Melogale*, distinguished by its heavy teeth, the lower second premolar disproportionately larger than the first, and the upper carnassial with its external edge convex instead of practically straight. A smaller race occurs in Tonkin, and probably will be found to reach the southern borders of Yunnan, *Helictis (Melogale) personata tonquinia*; another small-toothed subspecies *H. (M.) personata laotum*, is named from north-eastern Siam. This subgenus is further distinguished from typical *Helictis* (type *H. moschata*), by the characters of the baculum or penis bone, which, as Thomas points out, is bifid terminally, with the prongs thick-



ened, one forming a curved crest, whereas in *H. moschata* the tip is trifid, with the slightly thickened terminal prongs set in a triangle. There is evidence that this difference is not so trenchant as might appear, for in a baculum of *H. (M.) p. tonquinia* in the Museum of Comparative Zoölogy there is, in addition to the two large thickened lateral prongs, a small ventral knob representing the third one, that is more fully developed in *H. moschata*. An additional peculiarity of *Melogale*, not mentioned by Thomas, appears very clearly on laying out the series of skulls available, namely, the very different character of the temporal ridges. In *Melogale*, these are heavier and more nearly median, curving strongly inward from the supraorbital processes so that their point of closest approximation is about the diameter of the orbit behind these processes, and from there back the ridges diverge very slightly. In *Helictis* as represented by the *moschata* group, the ridges are less heavy, much wider apart, and either parallel or slightly bowed outward over the braincase, occasionally converging at their posterior ends.

The close similarity of these two species makes it seem likely that their geographic ranges are mutually exclusive or nearly so. Anderson (Zool. Res. Yunnan) long ago recorded *H. moschata* from western Yunnan, but the specimen is possibly referable to the animal Thomas named *millsi* of Assam, no doubt to be regarded as the westernmost race of *H. moschata*. A further interesting point is the occurrence of a smaller species, *H. taxilla* Thomas, closely resembling *H. moschata* but of very much less size. Originally discovered in Tonkin, French Indo-China, the collections made by Mr. Clifford H. Pope for The American Museum of Natural History have resulted in extending its known distribution to Fukien Province, a thousand miles to the northeast, where it is represented by the large-toothed race described below.

#### ***Helictis moschata* Gray**

*Helictis moschata* GRAY, 1831, Proc. Zoöl. Soc. London, I, p. 94.

The type locality is Canton, Kwangtung Province, South China, where the original specimen was secured by John Reeves. A series of 17 skins and skulls, secured by Mr. C. H. Pope in Hainan, is provisionally referred to the typical race in the lack of specimens from elsewhere in South China for comparison. Dr. J. A. Allen, in his list of the mammals of Hainan, follows the same course.

#### ***Helictis moschata ferreo-grisea* Hilzheimer**

*Helictis ferreo-griseus* HILZHEIMER, 1905, Zoöl. Anz., XXIX, p. 298.

The type is a skin purchased in Hankau, Hupeh Province, and no doubt came from that general region. If the Hainan skins are correctly referred to typical *H. moschata*, those from Fukien and eastern Szechwan represent a larger race with grayer tone to the pelage, for which Hilzheimer's name is available. The average measurements of a series of skulls show that the northern animal is larger by several millimeters in most of its dimensions and the color is usually without the buffy tint to the white under parts and pale bases of the hairs above, though occasional specimens agree with the more southern animal in the pale orange suffusion of the lighter areas. Males average a very little larger in cranial dimensions than females. Specimens were secured at Futsing, Yenping, and Chungansien in Fukien Province, and at Wanhshien in eastern Szechwan, and Yochow, Hunan.

***Helictis taxilla sorella*, new subspecies**

TYPE.—Adult male, skin and skull, No. 85030, American Museum of Natural History, from Futsing, Fukien, China. February 21, 1926. Clifford H. Pope, collector; Third Asiatic Expedition.

DESCRIPTION.—Externally similar to *H. moschata* in general appearance, but much smaller, the ears slightly larger in proportion, the claws of the fore feet slightly more curved, the metatarsal pads shorter; the skull is relatively more slender, less inflated, and with a narrower muzzle. From typical *H. taxilla* of northern Tonkin this Chinese race is distinguishable by its smaller skull in combination with the large size of the teeth, which are even slightly larger than in *taxilla*.

Color, pale chocolate-brown above, becoming hoary on the sides; tail long-haired and narrow, the chocolate hairs predominating on the basal half, the white-tipped ones on the distal portion. The pelage above has the proximal part of the hairs dull whitish. Notwithstanding that the white and dark head-markings are "about as in *moschata*" (Thomas) the four specimens from Fukien differ from that species in the following points: the white interorbital spot tends to be more linear than broad (in one it extends from nose-pad to crown as a broad line); the cheeks behind the eye are grizzled chocolate-gray and whitish, whereas in *moschata* a distinct dark spot extends backward from the posterior corner of the eye and is surrounded above and below by an area of clear white; finally a third distinctive mark of *moschata* is the presence of a small elongate chocolate spot beginning about 5 mm. behind the angle of the mouth and embracing a small clump of dark vibrissæ, but in the four specimens of the smaller species this spot is without exception absent and the corresponding vibrissæ are white or poorly developed. The ventral surface of the body, including the fore legs to the wrist and the hind legs nearly to the ankles, is dull white. Inside of ears and their outer rim whitish.

SKULL.—This is a replica on a smaller scale of the skull of *H. moschata* but, as Thomas has pointed out in his description of *H. taxilla*, it is more slender, especially in the rostral part, with a low and less inflated braincase. The female, however, seems to have a slightly more inflated skull than the male. The temporal ridges are wide

apart and nearly parallel. The tooth rows are very nearly as long as in *H. moschata* and slightly longer than in *H. taxilla*, but the individual teeth are as large as in the former species, resulting in a more slender attenuate rostrum for their accommodation. The distance between the upper molars equals the width of the postpalatal tube whereas in the larger *H. moschata* it exceeds that width.

**MEASUREMENTS.**—The collector's measurements of the type and a female topotype are respectively: head and body, 330, 320 mm.; tail, 140, 150; hind foot, 40, 40. In the dried skin the hind foot without claws measures in each 45 mm.

The skull of the type measures: greatest length, 71 mm.; basal length, 63.8; palatal length, 33.6; orbit to tip of rostrum, 24.8; zygomatic width, 37.0; mastoid width, 30.2; width across outer corners of molars, 18.2; interorbital width, 16.3; depth of braincase including bulla, 25.2; upper cheek teeth, 23.0; lower cheek teeth (canine to molars inclusive), 27.0.

This smaller species bears so close an external resemblance to *H. moschata*, that it may easily be confused with it. A close examination, however, shows that in addition to its smaller proportions, it differs in the gray instead of white cheek markings, the lack of a rectal dark spot, the much shorter metatarsal pads, and the weaker and slightly curved instead of nearly straight fore claws. In the case of two species so alike in structure living in the same region, one suspects a difference in habits, and it may be that the last two points indicate modifications for tree-climbing instead of terrestrial life.

#### ***Meles meles leptorhynchus* Milne-Edwards**

*Meles leptorhynchus* MILNE-EDWARDS, 1867, Ann. des Sci. Nat., Zool., (5) VIII, p. 374.

A badger with the under side from chin to root of tail and the feet blackish to blackish brown. A white stripe from the angle of the mouth on each side to and beyond the base of the ear, and a median one from muzzle to eyes or occiput, as well as a blackish stripe from muzzle including the eye; all merge at the back of the head in the grizzled black and buffy white of the rest of the dorsal side.

The black instead of white throat and the white instead of grizzled tail distinguish skins of this genus at a glance from those of *Arctonyx*. Compared with the European badger, the Chinese form has the white facial stripes shorter and the pale tips of the hairs above are less extensive and tinged with buffy instead of being pure white. The median white stripe on the muzzle is usually clear and broad to or slightly past the level of the eyes, beyond which it becomes smoky brown or even heavily brown, but in one of eleven skins is darkened quite to the nasal pad. Matschie's *M. tsingtauensis* is based on a nearly normal specimen with the stripe

extending to the eyes. Matschie's *M. hanensis* and *M. siningensis* are also synonyms, based on slight individual variations in color.

The relationship of the Chinese badger to the European *M. meles* seems, on examination of a series of both, to be not more than sub-specific. The color pattern is the same, except that the white head-markings are more obscured in the former, and its general tone is a little more buffy. The European animal is distinctly larger of skull with a better developed median crest. It also may occasionally have the first upper and first lower premolar ( $p^1$  and  $p_1$ ) present as small spicules but more often the upper one is altogether lacking and the lower one frequently, while in old age both are deciduous. In the Chinese badger, on the other hand, there seems to be no indication that the first small premolar is ever present, for in all the specimens at hand there is not even a space where it might stand in the toothrow. The slightly greater inflation of the bullæ is noticeable in Asiatic specimens, even in those of Asia Minor, which thus afford an intermediate condition.

***Arctonyx collaris collaris* F. Cuvier**

*Arctonyx collaris* F. CUVIER, 1825, 'Hist. Nat. des Mamm.,' pt. 51 (2 pp., Pl.).

A large, short-limbed badger, with pale claws; a white forehead stripe, and a shorter one below the eye; throat, ears, and tail white; feet and belly black. The fur of the back is basally white with a black terminal portion, or the black band may be succeeded by a white or a yellowish tip, so that specimens from the same locality may be black-backed or largely grizzled gray, often with a yellowish tinge.

The precise relationships of the Asiatic hog-badgers still require to be more carefully worked out with adequate material. The collections of the Asiatic Expeditions include fourteen skins and eight skulls from various localities in China and these show a considerable amount of variation which seems individual rather than geographic. Skins from the same region vary in color from those having white head-markings and black nape and back (with white bases to the hairs) to those with the facial markings tinged with ochraceous, the nape, shoulders, and all the hairs of the back white-tipped or ochraceous-tipped. A light-colored specimen of the latter type served as the basis for Thomas's *A. leucolæmus orestes* from the Tsingling Mts., Shensi. I cannot see that specimens occurring from Yunnan across South China to Fukien differ materially from *A. collaris* of Bhutan, judging from descriptions of the latter, and allowing for certain inaccuracies in the original figure as to the thinly

haired tail. Anderson, who examined the type of *A. obscurus* from western China, regarded it as a young animal identical with *A. albogularis*, itself doubtless the same as *A. collaris*, and Milne-Edwards also admits the close similarity. Wroughton in his summary list of Indian mammals (1919, Journ. Bombay Nat. Hist. Soc., XXVI, p. 347) states that the greatest length of skull in *A. collaris* is 135 mm., which is almost precisely that of adult skulls from Fukien (condylobasal length 135.7–136 mm.). Thomas, in 1922, described as *A. obscurus incultus* an old male from Anhwei, which differs in its thin coat and the great inflation of the sides of the posterior tubular part of the palate. The former character, however, is likely to vary seasonally as it obviously does in the Fukien and Yunnan skins, while the degree of inflation of the palate varies considerably in skulls from the same locality in Fukien. I am, therefore, regarding all the specimens in the present series from Lichiang, Yunnan Province, and from Chungan, Yenping, and Futsing, Fukien Province, as *A. collaris collaris*.

***Arctonyx collaris leucolæmus* (A. Milne-Edwards)**

*Meles leucolæmus* A. MILNE-EDWARDS, 1867, Ann. des Sci. Nat., Zool., (5) VIII, p. 374.

Smaller than the typical form, skull with condylobasal length of 123 mm., the white collar usually complete; the dark color of the back extending on to the basal part of the tail.

Three skins labelled from Chihli Province represent this slightly smaller subspecies. In Milne-Edwards's figure of the type from the environs of Peking, the white collar extends broadly across the nape, passing gradually into the grizzled, white-tipped hairs of the back. The three skins above noted show this collar but the entire back is black, lacking the white-tipped hairs. The skulls of two of these (labelled males) are aged and considerably smaller than those of South China animals, with the posterior tubular part of the palate hardly inflated at all. They agree in small size with the type skull as figured by Milne-Edwards. The third skin is not accompanied by a skull. In 1923, Lönnberg (Ann. Mag. Nat. Hist., (8) XI, p. 322) described as *A. leucolæmus milne-edwardsii* a hog-badger from the Minshan, southern Kansu, the chief characters of which are the black instead of grizzled dorsal surfaces, and the presence of a minute premolar ( $p^1$  and  $p_1$ ) in both jaws. He calls attention to a similar tooth variation in a specimen from Shensi recorded by Milne-Edwards. The skull of the type, a subadult female, is small, like that of Chihli specimens (123 mm. long), while the material now at hand shows

that the variations in color and in the presence or absence of the minute anterior premolars are altogether individual, for the skins from Chihli are similar in their black backs to that from Kansu, while of two skulls from Chihli, one has  $p_1$  in the left lower jaw; and in six others from South China representing *A. c. collaris*, two have  $p^1$  present in the left upper jaw, and all have  $p_1$  on both sides in the lower jaws. It is obvious that this small tooth is in process of disappearance, and so is either quite absent or represented by a minute spicule, of varying size. The Minshan hog-badger is thus similar to that of Chihli and both seem to represent the slightly smaller, white-naped race, *A. collaris*, described by Milne-Edwards.

*Lutra lutra chinensis* Gray

*Lutra chinensis* GRAY, 1837, Mag. Nat. Hist., (2) I, p. 580.

A clawed otter with the upper outline of the naked nose-pad W-shaped, instead of nearly straight across; general color light chocolate-brown, lips white, longer hairs of the lower surface white, the under-fur pale brown, whitish at base.

Two otter skins, one from Nodda, Hainan, the other from Yenping, Fukien Province, are quite similar in color and evidently represent Gray's *L. chinensis*, the type of which was sent from China by Reeves, hence probably from near Canton. They are decidedly paler than European and Japanese skins of *Lutra lutra* and probably somewhat smaller, although the skulls indicate that the animals are hardly more than adult. The upper border of the nose-pad is W-shaped, with a decided central triangular point, as in the *L. lutra* group. It is probable that Matschie's *Lutra hanensis*, based on a trade-skin purchased in Hinganfu, southern Shensi, may represent the Indian and Burmese species, *tarayensis*, in which the outline of the nose-pad is nearly straight above as he describes it.

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VIVERRIDS FROM THE ASIATIC EXPEDITIONS<sup>1</sup>

BY GLOVER M. ALLEN

The Viverridæ, or civets and their allies, is a family characteristic of tropical and subtropical climates where it largely takes the place of the Mustelidæ or weasels, although a few species extend northward into warm-temperate regions. The collections made by the Asiatic Expeditions, under the direction of Dr. Roy Chapman Andrews, include over two hundred skins, mostly accompanied by skulls, from South China, particularly from Hainan, Fukien, and Yunnan Provinces. Although these seem referable to but six species, the series of each is in most cases so large as to give an adequate idea of the range of individual, sexual, and geographical variation and to allow a fair estimate of the validity of sundry names bestowed in recent years upon certain Chinese specimens. Although no new forms were recognized it has seemed worth while to list the species taken, with critical notes on each.

*Viverra zibetha* Linnaeus

*Viverra zibetha* LINNÆUS, 1766, 'Syst. Nat.', 12th Ed., I, p. 65; Bengal (see Thomas, 1911, Proc. Zool. Soc. London, p. 137).

The collection contains a magnificent series of over fifty civet skins, chiefly from Fukien and Szechwan, and includes five from western Yunnan (Lichiang, and Namting River); but in the absence of specimens from India they are all referred provisionally to the typical race, notwithstanding that several subspecific names have been proposed on the basis of one or several skins each. Thus, in 1864, Swinhoe described as *Viverra ashtoni* a specimen from Min River, Fukien Province, which lacked obvious cross-bands on the haunches and had the black dorsal stripe continued to the third dark tail-ring instead of ending (as commonly) with the first. Matschie, in 1908, renamed the Chinese civet *V. filchneri* on the basis of skins secured at Hinganfu, southeastern Shensi, claiming as distinctive characters the presence of wavy cross-bands on the haunches, six instead of five broader black and six narrower white

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 90.

tail-rings unconnected with one another dorsally (except that the basal dark ring is united medially with the dorsal stripe), a black tail-tip, a pronounced broadening of the middle dark neck-band, and smoke-gray underfur. More recently, Wroughton (1915, Journ. Bombay Nat. Hist. Soc., XXIV, p. 64) gave subspecific names to two supposed Indian races, *picta* from the Upper Chindwin River, Burma, and *pruinosa* from Little Tenasserim River, Burma. He later (1918, idem, XXVI, p. 46) regarded the former as untenable, but distinguished the latter race by its clear gray without a general yellow tinge to the ground color. Robinson and Kloss have since (1920, Rec. Indian Mus., XIX, pt. 4, p. 176) added another supposed race, *sagillata*, from peninsular Siam, differing in the sharper definition of its markings. Wroughton adds that one of his specimens from Upper Chindwin River is exactly like a skin in the British Museum from Shensi, while Robinson and Kloss maintain that specimens from Tenasserim are invariably more yellow than true *zibetha* instead of grayer as Wroughton claimed.

The present excellent series secured by the Asiatic Expeditions indicates that in all the characters mentioned there is considerable variation. In skins from the same locality, the usual buffy ground-color of the body may be replaced by clear gray—a mixture of white-tipped and blackish hairs; the pattern on the flanks may be extremely indistinct with every gradation to inobvious spots and blotches and even indistinct cross-stripes that become well defined on the rump. The number of rings on the tail is usually twelve, six white and six black, the terminal one black, but it may be five of each, while one from Yenping, Fukien, had no less than eight of each, the last three black ones very close together and separated by very narrow white rings. Usually only the basal black ring is connected dorsally by an extension of the median stripe of the body, but occasionally this may continue to the second or third and even beyond, showing as a few scattered black-tipped hairs. In specimens with a well-developed yellowish tint, it is usual to have the basal one or two black tail-rings provided with a pair of ochraceous centers, separated by the black median stripe. In one exceptionally bright skin from Fukien these centers are rusty in color and are indicated as scattered hairs of that hue on the third black ring. A single female skull from Hainan is slightly smaller in its dimensions than Fukien specimens.

It is obvious that all the characters hitherto used in the attempt to discriminate local races of the civet are subject to wide individual variation, and since there seem to be no striking differences in cranial measurements, I refer all Chinese examples to the typical form.



**Viverricula malaccensis malaccensis** (Gmelin)

*Viverra malaccensis* GMELIN, 1788, LINNÆUS'S 'Syst. Nat.,' 13th Ed., I, pt. 1, p. 92.

A medium-sized civet, grizzled gray and black with a blackish stripe extending along the side of the neck from the posterior base of the ear, and having five to eight narrow dark stripes on the back that become broken into lines of spots laterally; feet and a small crescent about the anterior part of the eye dark brown; tail with six to nine dark rings alternating with white or buffy-tinted rings.

The type locality is Malacca and, although several subspecies have been recognized, Wroughton, in 1918, writes that he has entirely failed in finding one that seems valid. The series now available through the work of the Asiatic Expeditions comprises fifty-eight skins, mostly with skulls, from Yunnan, Szechwan, and Fukien, and twenty from Hainan. The Hainan series is uniformly slightly smaller in size of skull and with one exception represents the gray phase of pelage, while the others are larger of skull, have longer tails, and are practically all of the rufescent type. Since the former series agrees in skull measurements with those published for typical *malaccensis*, I am referring them to that form, the range of which probably includes the entire Malay Peninsula to the Chinese border and Hainan, for Thomas has lately identified as of this race the specimens taken by the Delacour Expeditions. Females average a few millimeters shorter than males in length of cranium and of toothrows.

**Viverricula malaccensis pallida** (Gray)

*Viverra pallida* GRAY, 1832, Proc. Zool. Soc. London, p. 63; 1834, 'Ill. Indian Zool.,' II, Pl. VI.

Similar to the preceding but the skull slightly longer in its dimensions (average condylobasal length of ten adult males 100.8 mm. against 95.6 in five adults from Hainan). Color averaging more ferruginous, tail longer, winter pelage longer and with less obvious stripes.

In his review of this genus in 1898, Bonhote regarded the Chinese animal as distinct, and used for it Gray's name *pallida*, based on the colored plate of a specimen sent by Reeves from China, though he published the same name earlier as a *nomen nudum*. While Reeves's animal probably came from the vicinity of Canton, and may therefore not be very different from typical *malaccensis*, yet the series from Fukien, not far to the northward, is so evidently different from the Hainan specimens taken as representing the typical form that it seems safe to apply Gray's name to them. This series of nearly sixty skins shows that the ferruginous phase is the usual one, and that the grayer type of coloring is

very rare. In winter skins the pelage is much longer than that of the more tropical animal and has the stripes and spots much obscured. The number of rings on the tail, which has been used as a distinguishing mark, varies within narrow limits from occasionally as few as six to rarely nine, or even ten.

Mr. C. H. Pope, who secured most of the Fukien series, says that this is chiefly a ground-living animal, frequenting thickets and covered ravines, whence it may easily be driven by dogs.

Its range in China extends north to the Yangtze Valley, where specimens were secured by Mr. Granger at Wanh sien. Two others from southern Yunnan seem to be the same, and differ in their narrow, less inflated bullæ from the only Indian skull available. It seems likely that *V. m. thai* Kloss of Central Siam will prove not distinguishable from typical *malaccensis* by which its range is surrounded.

#### ***Paradoxurus hermaphroditus laotum* Gyldenstolpe**

*Paradoxurus hermaphroditus laotum* GYLDENSTOLPE, 1917, Kungl. Sv. Vet. Akad. Handl., Stockholm, LVII, No. 2, p. 26.

A series of eight adult skins from Hainan evidently represents the *hermaphroditus* group and, to this species, Dr. J. A. Allen has referred other Hainan specimens. The typical form, however, is restricted on the mainland to the southern portion of the Malay Peninsula, while in southern Siam (Trong) a slightly paler form is interposed, *P. h. rarus* Miller, 1913. Very recently Thomas has listed specimens from Annam as *P. birmanicus* Wroughton (type from near Sagaing, upper Burma), and it is unlikely that the Hainan specimens are very different for they agree fairly well with the description. Gyldenstolpe has shown, however, that his *P. h. laotum* is the same and was published over a month earlier, so that it is here used provisionally for the Hainan animal.

In the series of adults there are five distinct dorsal black stripes on a ground that varies from pale grayish buff to nearly golden. In one the entire throat to the upper chest and the sides and crown of the head are shining black, but in most these parts are much mixed with paler hairs; feet and tail black, the latter at its base more or less mixed with paler hairs, particularly on the lower side.

The only other paradoxure yet known from China is *P. exilis* Schwarz, from near Canton, a small animal, probably a race of *P. minor* Bonhote.

#### ***Paguma larvata larvata* (H. Smith)**

*Gulo larvatus* H. SMITH, 1827, in Griffith's 'Animal Kingdom,' II, p. 281, Pl.

A palm-civet without stripes or tail-rings. Head and nape to shoulders black; a white blaze on forehead sometimes extending a varying distance on to the occiput or neck as a narrow line of white-tipped hairs. A white mark below and another above the eye extending to base of ear and below it, often to a nearly complete half collar. Upper parts and proximal portion of tail grayish to ochraceous; feet and terminal half of tail blackish brown.

With the fine series of over thirty skins secured by the Asiatic Expeditions, I have attempted to review the nomenclatural history of this species. The name *Gulo larvatus* was given, in 1827, by Hamilton Smith, to a specimen in the Leiden Museum, that had been so labeled by Temminck; his colored plate from the same specimen is a fair representation of the animal as we now know it from South China, but the original locality was unrecorded. Temminck who later, in his 'Monographies' (1841, II, p. 329, Pl. LXV, figs. 1, 2), described it as *Paradoxurus larvatus* and figured the skull, stated that it had been obtained from London. Gray (1831, Proc. Zool. Soc. London, p. 95; 1832, p. 67) had meanwhile redescribed the species on the basis of a specimen from the vicinity of Canton, China, sent by Reeves, referring it first to a new genus, *Paguma*, then to *Paradoxurus*. Of this specimen he published a colored figure (1834, 'Ill. Indian Zool.,' II, Pl. XI), which, though in many respects crude, is nevertheless again a fair representation. For nearly three-quarters of a century the name stood, until Matschie, in 1908, concluded that Hamilton Smith's figure was really that of the Formosan race (named *taivana* by Swinhoe), and hence he renamed the subject of Gray's plate *Paguma reevesi*. Thomas has shown the distinctness of the island race and (1909, Ann. Mag. Nat. Hist., (8) III, p. 377) that it does not really correspond to H. Smith's description as well as do specimens from the lower Yangtze; moreover, it is unlikely that at that early date a living palm-civet would have reached London from Formosa, but while Thomas does not say that Hamilton Smith's animal is identical with Reeves's, I think it may safely be assumed that they both represent the typical form of South China. Thomas then proceeded to describe a new race, *hainana* from the island of Hainan, and by a curious coincidence, Dr. J. A. Allen also described the same form using the same subspecific name. His paper was issued April 17, 1909, while Thomas's was received at Cambridge, Mass., on the previous day from England, so that the latter author must stand as authority for the name. In the following year, Wroughton described as *P. l. intrudens* a large brightly colored race from Yunnan and Burma, the type locality, Myitkyina, North Burma, less than forty

miles from the border of western Yunnan. In 1919, another race, *vagans*, with the hair of the upper parts black-tipped, was named from western Siam by Kloss, and finally, Thomas in 1921, added two more subspecific names, *yunalis* for the animal of western Yunnan, and *rivalis* based on a pale skin from Ichang on the Yangtze. As a basis for these various names, the material previously available has been admittedly inadequate, quite insufficient to indicate the range of variation in any single area. The series collected by the Asiatic Expeditions includes sixteen from Fukien Province, four from Szechwan, about 150 miles from Ichang on the Yangtze, a specimen from Chekiang Province, and eight (all but one without skulls) from western Yunnan. There is also a single young animal from Hainan. A careful consideration of this material makes it pretty certain that only two continental races are represented, namely, one from western Yunnan and the other from eastern Szechwan to the coast. The latter is the typical race, *larvata*: the former should probably stand as *intrudens*, of which *yunalis* would be a synonym.

The range of color variation shown by the Fukien series is considerable. The average skin has the entire back pale ochraceous buff, fading into nearly clear gray on the sides and belly. The underfur is smoky. The base of the tail is colored like the back, the terminal portion becoming black. The white blaze on the muzzle usually extends back between the ears and the whitish mark behind the ear seldom makes more than a narrow crescentic patch on either side. In the same series are individuals in which the ochraceous tinge becomes so reduced as to be practically wanting or in others very faint. At the opposite extreme are one or two in which the ochraceous tips of the body-hairs are so intensified that they are as bright as in the Hainan skin. While the black tip, on the average, includes the terminal half of the tail, in one it is only about a third, while three of the series (two from Fukien, one from Szechwan) lack the black tip altogether and have tails wholly gray or gray tinged with pale ochraceous. A specimen of this type from Kiating, Szechwan is recorded by Jacobi as *Paguma l. reevesi*, but he wisely remarks that it would be unwarranted to found a new race upon it, occurring, as it did, within the range of the typical form. The black tail-tip may be rather well defined, or it may extend as a darkened stripe nearly the whole length of the dorsal side of the tail. The amount of black in the subterminal portion of the longer hairs is further subject to much variation, while the exact extent of the white head-markings is hardly the same in any two skins. The usual condition, however, is to have the white frontal blaze continued back between the ears, but in at least two of the series (from

Fukien) it may be traced as a narrow line of white-tipped hairs nearly to the shoulders. A specimen from Wanhhsien, Szechwan, however, has it well developed to the withers, approaching the condition found in *P. l. intrudens*. While usually more or less of the mustachial vibrissæ are white, in occasional skins they are all black. The chin is black, the throat mixed grayish.

This is an animal of the southern parts of China, hardly extending northward of the Yangtze basin. Mr. C. H. Pope writes that it is said to live in holes and is captured by being smoked out. Of the series secured in the Fukien and Szechwan Provinces, it is noticeable that a large proportion, though nearly full-grown, still have the well-developed milk dentition. This set of teeth evidently is retained for a considerable period, is perfectly functional, and not greatly inferior to the permanent set. Within narrow limits the individual teeth vary a good deal in size among specimens from the same locality and apparently independently of sex, so that too much reliance cannot be placed on the size of the teeth as a racial character. The peculiarly carinate audital bullæ are an interesting feature of the skull.

***Paguma larvata intrudens* Wroughton**

*Paguma larvata intrudens* WROUGHTON, 1910, Journ. Bombay Nat. Hist. Soc., XIX, p. 793.

Similar to *P. larvata* but larger, the back a brighter, deeper tone of ochraceous, the white mark of the forehead extended as a broad stripe to the shoulders, and the facial markings, including the whitish half-collar, more clearly defined.

The type locality is Sima, near Myitkyina, in northeastern Burma, a short distance from the borders of Yunnan, and marks very nearly the western bounds of the species' range. The slightly larger size of the type and of individuals from western China is indicated by the longer skull, 118-120 mm. from back end of occipital crest to gnathion, as against an average of 113 mm. in Fukien specimens. Wroughton considered the few available specimens from western Yunnan the same as his Burmese race, but Thomas in 1921 described as *yunalis* two individuals that were brighter in their ochraceous tint, and with very small suborbital white mark. The type locality is given as Yen-yuen-sien, Yunnan, but it is really in southern Szechwan, about 250 miles east of Wroughton's type locality.

The series of skins secured by the Asiatic Expeditions from Lichiang and the Namting River shows, however, that the white suborbital mark

is normally large and well defined instead of being a "mere vague streak," while the slight amount of variation in the ochraceous shade of the back is probably also chiefly an individual matter. I have therefore ventured to place the name *yunalis* in the synonymy of *intrudens*, which will be the name of the masked palm-civets of southern Szechwan to north-eastern Burma, south through western Yunnan to central Tonkin, whence Thomas has lately recorded specimens under the former name.

While the average skin of *intrudens* shows the white nuchal streak extending as a well-marked line to the shoulders, one from Lichiang has it very narrow and confined to the tips of the neck hairs, ending some 80 mm. from the posterior edge of the black shoulder area, while a second represents the opposite extreme, for the stripe, after continuing quite to the end of the black area, is interrupted for about 35 mm. and then continues indistinctly nearly the whole length of the back. Wroughton mentions a somewhat similar specimen. As in the typical race, an occasional specimen has an all-gray tail, without the black tip.

#### ***Herpestes urva* (Hodgson)**

*Gulo urva* HODGSON, 1836, Journ. Asiatic Soc. Bengal, V, p. 283.

A large mongoose with coarse, grizzled pelage of black and buffy or whitish; feet dusky brown, tail becoming whitish to buffy or ochraceous in its terminal part; a conspicuous white stripe from the corner of the mouth to the shoulder.

The so-called crab-eating mongoose is found in the lower country of South China. The collection contains a skin from Chinkiang, a fine series of 27 secured by Mr. Clifford H. Pope and Rev. H. R. Caldwell in Fukien, as well as four taken by the former collector in Hainan.

Matschie in 1908 gave the name *Urva hanensis* to the Chinese animal on the basis of four skins from Hankow, which, although no specimens from India were available for comparison, appeared to differ from the original description in the following particulars: (1) chin brownish gray, much mixed with white, instead of being white; (2) underfur on the head dark brown with a gray tone instead of light reddish brown; (3) under side ochraceous, feet blackish brown instead of both under side and feet dull brown; (4) tail 250 mm., instead of 275-300 mm. In the matter of color, however, the series at hand shows considerable variation not only in the extent of the white tipping to the hairs, the amount of white or brown on chin, throat and feet, but also in the intensity of the buffy tint, so that in some the underfur is almost whitish, in others rusty, and the

basal portion of the long hairs on the tail varies between similar extremes. The measurement of the tail likewise seems not to be distinctive, so that until more obvious differences can be shown, Matschie's name is best regarded as a synonym. Of the four specimens from Hainan, two are immature, but the two adults are very dark in appearance due to a decrease in the extent of the white hair-tips and a corresponding increase in the black subterminal rings. One or two of the Fukien skins are indistinguishable, however, so that it is hardly feasible to separate the island animal.

***Herpestes rubrifrons* (J. A. Allen)**

*Mungos rubrifrons* J. A. ALLEN, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, p. 240.

A medium-sized species; long hairs ticked black and buffy white giving a finely grizzled appearance; head washed with ferruginous, and the long hairs of the tail faintly tipped with ochraceous; backs of feet russet, belly yellowish drab.

Several additional specimens from Hainan represent this species, the relations of which are apparently with *javanicus* of Java or the mainland *exilis* of Tonkin and Siam. There seem to be no records of other species of mongoose than *H. urva* from the mainland if we except Hilzheimer's *H. albifer* based on skins bought at Hankow. These may even prove to be young of *H. urva*, though Hilzheimer believed they were related to *europunctatus*.





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## CARNIVORA FROM THE ASIATIC EXPEDITIONS

By GLOVER M. ALLEN

In previous papers, brief reports have been made on the Mustelidæ and Viverridæ secured by the Asiatic Expeditions under the leadership of Dr. Roy Chapman Andrews for The American Museum of Natural History. The remaining groups of Carnivora are here dealt with, including the bears, wolves, foxes, and cats (families Ursidæ, Canidæ, Felidæ) of which a magnificent series of skins and skulls was brought back, adequate in some cases for a tentative revision of the many names applied to certain eastern species. The discrimination of geographic races among the larger predaceous mammals is often difficult. Sufficient series from a single region are seldom available for the determination of normal individual variation in color, pattern, or proportions, which has resulted in the frequent bestowal of new names on a quite inadequate basis. Moreover, large carnivorous mammals may often have a wide individual range, so that local varieties are not so easily established as in the case of smaller and more sedentary species. So far as possible, therefore, I have attempted to review critically the various names and descriptions involved for the region covered.

### Ursidæ

#### *Selenarctos thibetanus* (Cuvier)

*Ursus thibetanus* F. CUVIER, 1824, 'Hist. Nat. des Mamm.,' Pl. CCXIII and text.

The Asiatic black bear is given generic rank as distinct from the typical genus *Ursus* on account of its color (black with a white crescent on the chest), and the formation of the plantar pads, which in the fore paws have an enormous carpal pad continuous with the palmar pad, while of the digital pads the first and fifth only are continuous with the latter. The species is forest-living and occurs from India to Manchuria and South China. A number of local races have been named, but it must be admitted that the discrimination of most of these rests upon

<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 91.

a very slender basis, since nearly all are described from single skulls, often of unknown age or sex and without adequate comparison with the typical form. In these large species not only is the individual and sexual variation in skulls so great as to be readily apparent, but the changes coincident with age are also striking. Moreover, these are wide-ranging animals, and a single one may travel over more territory in a day than a mouse or shrew would cover in its entire lifetime, a factor tending to prevent the ready development of local forms. Increasing age is accompanied by a great increase of zygomatic width, accentuation of the lambdoid and sagittal crests, and by the enlargement and deepening of the glenoid cavity of the jaw, so that the cranium of an old bear when placed on a flat surface rests upon the glenoid portion of the skull or the paroccipital processes, instead of upon the condyles as it does in immature animals. Age is also accompanied by a fusion of the cranial bones, so that in adults the outlines of the frontal, parietal, and finally the nasal bones become quite obliterated.

The Asiatic Expeditions secured four skins and skulls of black bears from the forests near Eastern Tombs, Chihli Province, which are thus topotypes of *S. t. wulsini* Howell. Unfortunately, the sex of none of these is known. Two are immature while the two others are adult, the larger perhaps a male. An adult female was also secured at the base of Tai Pei Shan, Shensi, and there are further, available for comparison, four adult skulls from northwestern Corea, Hupeh Province, and "India" respectively, the last representing typical *thibetanus*. A careful comparison of all these, and of the descriptions of *macneilli*, *mupinensis*, and *wulsini* reveals no single character whereby any local form of northern China may be distinguished. Sowerby (1920, Journ. Mamm., I, p. 213) has reviewed the bears of eastern Asia, particularly with a view to identifying those described by Heude, practically all of which he regards as valid species without recharacterizing them. He admits that *S. ussuricus* is much like *S. thibetanus* except that it "seems to have longer hair on the sides of the head and neck." The chief difference is believed to lie in the large size of the last upper molar, which in Manchurian specimens was 27 mm. long in a female, 31 mm. in a male, against 24 mm. in a female of *thibetanus* from the Himalayas and 28 mm. in a specimen representing *mupinensis*. However, in two skulls (unsexed) from India in the Museum of Comparative Zoölogy, representing *thibetanus*, the length of this tooth is 27 and 33 mm. respectively. In the Chihli series it varies from 28 to 32 mm. Evidently there is nothing diagnostic in the size of this tooth as a racial character. Lydekker's *macneilli*, from "some distance"

west of Ta-chienlu, Szechwan, was supposed to differ in its smaller cheek teeth, last molar 25 by 15 mm., but in a skull from Hupeh (M. C. Z. No. 11770) this tooth is 30 mm. long. In *S. t. wulsini* the smaller size of the white chin-spot as compared to *ussuricus* was believed by its describer to be diagnostic, but the series of topotypes secured by the Asiatic Expeditions shows that this, like most white markings in mammals, is very variable and may be large or small (varying in four skins from 45 to 130 mm. in length). In *mupinensis* it is also said to be very small. It is evident from a study of the available material and descriptions that individual variation will account for most of the supposed racial characters in the subspecies described, and that no truly geographic differences have yet been pointed out that will separate the Himalayan black bears from those of North China.

***Selenarctos thibetanus melli* Matschie**

*Selenarctos melli* MATSCHIE, 1922, Arch. f. Naturgesch., A, LXXXVIII, pt. 10, p. 34.

Matschie, in 1922, gave the name *melli* to a black bear from Kwangtung Province, near Canton, in South China. The type was captured as a cub, and kept for some three years in captivity, hence may be presumed to show the usual abnormalities of captive animals. Its chief character is said to lie in its small size, for it shows the usual color pattern of *S. thibetanus*. A fine skin and skull from Chunganhhsien in Fukien Province was secured by Mr. Clifford H. Pope of the Third Asiatic Expedition and may be regarded as of the same race. It is an adult male with the teeth much worn and all the cranial sutures quite obliterated. In size the skull about equals that of an adult female from Shensi, and since adult females are smaller than males, this may indicate that *melli* is really a smaller subspecies of South China. The single specimen from Fukien is obviously of much less size than the large skulls of *S. thibetanus* assumed to be those of males. The skin, taken in April, is in excellent condition and much shorter-haired than the winter skins from Chihli. If this specimen adequately represents the South China black bear, it seems to indicate a valid race, characterized by its smaller size and shorter coat. Mr. Pope also secured a very young black-bear cub from the island of Hainan that doubtless represents the same animal. Although long ago recorded from this island by Swinhoe, no adult specimens of the black bear seem to have reached museums from Hainan.

**Canidae*****Canis lupus laniger* (Hodgson)**

*Lupus laniger* HODGSON, 1847, *Calcutta Journ. Nat. Hist.*, VII, p. 474.

The wolf of Mongolia and northern China does not seem to be very different from the typical European race. Three skulls, one of a male, measure about the same as European skulls though none equals in size the large Swedish skull, the dimensions of which are published by Miller (1912, 'Mamm. Western Europe'). In color, the seven skins secured by the Asiatic Expeditions vary considerably according to season and condition of wear, but the best one, killed near Urga, is decidedly pale, the muzzle pale ochraceous-buff grizzled with whitish, forehead slightly darker, backs of ears and an area about their bases contrastingly orange-rufous, fore legs pale buff without trace of the dark stripe on forearm; neck, body, and tail with the usual ochraceous element reduced to buff, the white rings of the guard hairs prominent. Other Mongolian skins are considerably darker: buffy grizzled with black and the forearm stripe may be well developed. The underfur is thick and woolly, in the winter coat especially. In view of the variation in color among wolves of the same region, from pale grayish animals to buff-colored specimens with greater amounts of black in the pelage, it is evidently unwise to recognize several species among them as Matschie has done, unless more essential differences can be established than those shown in the native skins without definite locality which were made by this author the basis of his *Lupus filchneri* and *L. karanorensis*. He also names a third species, *Lupus tschiliensis*, on the basis of a skull, sex unknown, from Chihli, but the measurements are identical with those of Mongolian skulls and the slight differences in cranial proportions upon which he relies are best regarded as purely individual variations. Probably Hodgson's name *laniger*, based on the wolf of Tibet, is applicable to the wolf of Mongolia and North China, an animal very little paler and smaller than that of western Europe.

***Canis rutilans* (S. Müller)**

*Canis rutilans* S. MÜLLER, 1839, 'Verhand. Zool. Zoogd.', pp. 27, 51.

Size of a small wolf; color bright rusty rufous, the tail blacker with a black tip; belly, throat, and edge of upper lip usually white.

Two skins from Yenping, Fukien Province, taken by Rev. H. R. Caldwell, seem to be the first definite records for the province. They are not certainly distinguishable in color from two other skins from western Yunnan (Namting River and Shafun). One of each pair has the belly suffused with the reddish tint of the back.

The type locality of this animal is Bengal, but probably it is not very different from the earlier described *Cuon javanicus* (Desmarest) of Java, of which it may eventually prove to be the mainland subspecies.

***Nyctereutes procyonoides* (Gray)**

*Canis procyonoides* GRAY, 1834, 'Illustr. Indian Zool.,' II, Pl. I.

Small, fox-like, with short bushy tail; color a mixture of buff, gray, and black, the black-tipped hairs predominating over the back and in a narrow dorsal line from the crown to the tip of the tail; a conspicuous blackish-brown patch on each side of the face from just in front of and below the eye to a point midway to the ear and continued as a narrower line behind the ear. The flanks, sides of neck, and the tail are chiefly a warm buff; feet blackish brown.

Gray's original specimen was sent by Reeves from China, hence no doubt from near Canton. The large series of some twenty specimens, collected mainly by the Asiatic Expeditions, includes ten from Fukien Province which may be taken to represent true *procyonoides*. Three others from eastern Szechwan (Wanhsien) are quite the same, as are also those from Kiangsu, Chekiang, and Hunan Provinces. There is a wide variation in color among skins from the same locality, some having the black-tipped hairs of the back so numerous as to darken the whole upper side while in others they are chiefly confined to the median dorsal line. The entire pelage is more or less suffused with pale ochraceous which is in some skins intensified to a bright rusty. Winter skins in good condition are longer-furred than those of summer. A Fukien specimen taken in December shows the extreme of the intensification, in being almost fox-red all over except for the usual blackish areas and the black-tipped hairs of the dorsal line.

Matschie, in 1908, gave the name *stegmanni* to the racoon-dog of the Yangtze basin, type locality Chunkiang, at the same time stating that the *N. sinensis* of Brass, also from the Yangtze Valley was a synonym of *procyonoides*. The characters he gives (based on a single skull) are, however, unreliable and do not hold good in the present series, so that both these names are undoubtedly synonyms of *procyonoides*. No specimens are at hand from North China, so that it is uncertain if the species varies geographically in that part of its range. Matschie gives names, however, to the slightly larger Ussuri animal as well as to that from Amur Land.

***Nyctereutes procyonoides orestes* Thomas**

*Nyctereutes procyonoides orestes* THOMAS, 1923, Ann. Mag. Nat. Hist., (9) XI, p. 657.

A slightly paler race. The type was an adult female from the north-western flank of the Likiang Range of Yunnan and constituted the first record of the genus in western China. Four additional skins (two with skulls) were secured from the same range by the Asiatic Expeditions, and show that the Yunnan animal is after all very similar to that of south-eastern China, differing chiefly in the gray instead of buff tone to the paler portions of the longer hairs, though there may be a very slight suffusion of buffy. The throat and feet are black in the type but brownish in the four other skins, while the nearly parallel condition of the zygomatic arches, which formed the chief basis of separation, is evidently an individual aberration since the two other skulls show nothing to distinguish them from those of the typical race. Thomas mentions the abnormal presence of an upper third molar on the right side in his specimen, a peculiarity found on the left side in a specimen collected by the Asiatic Expeditions in eastern Szechwan.

***Vulpes vulpes hoole* Swinhoe**

*Vulpes hoole* SWINHOE, 1870, Proc. Zool. Soc. London, p. 631.

Similar to the red fox of Europe but the sides and especially the thighs more mixed with gray, the fore feet usually with less black, and the red tones less fulvous but more chestnut. The tail has the chestnut confined more to the upper surface; the lower surface is buffy white, its longer hairs black-tipped. Below, white to gray or even pinkish.

A series of seventeen skins, mostly with skulls, from Fukien Province is instructive as showing the range of individual variation in a restricted locality. Although the average skin is more chestnut above with grayer thighs and has a tail that is paler below, clouded with slaty, as compared with European red foxes (Scotland and Germany), nevertheless, there are occasional individuals that differ very little indeed from these latter. In general, the clear chestnut area is confined to a rather narrow median stripe with ill-defined boundaries, becoming more rufous on the tail. The flanks are bright ochraceous frosted with gray-tipped hairs which especially predominate on the sides of the haunches. The blackish area on the sides of the muzzle may be well developed or very indistinct or wanting altogether. The black stripe on the front of the fore leg is usually narrow, bordered by rufous, but may be broad enough to cover the entire front of the leg and extend up on the shoulders. In dark specimens

the throat and belly are suffused with slaty where the dark bases of the hairs show through, and in one skin the wearing away of the white tips of the hairs forms an indistinct black collar. Usually a narrow line of clear bright ochraceous runs along the sides bordering the belly. The last is usually white with grayish underfur, but occasionally the whole under side of the body is deep pinkish buff. In the entire series no skin shows the blackish belly so often seen in Egyptian or European red foxes. Swinhoe, however, found this variation in Fukien and believing it to represent an upland race, named it *lineiventer*. But there can be but little doubt that all the foxes of South China are really referable to a single subspecies to which Swinhoe's first name is applicable, for specimens secured by the Asiatic Expeditions from Chekiang, Hunan, and Maitai Chao, Shansi, do not show any essential differences. Matschie, in 1908, gave several names to foxes from eastern Asia, based on skins purchased in fur markets, but probably most of these are synonyms of *V. v. hoole* or of forms already described from eastern Tibet. His *Vulpes aurantio-luteus*, presumed to have come from the mountains of the upper Yangtze, is doubtless the same as *V. v. hoole*, with which it exactly corresponds in its description.

The average condylobasal length of four adult males from Fuching, Fukien, is 135.1 mm., of four females 127.8 mm.

A beautiful skin from Lichiang, Yunnan, is unusually deep in color, the fore and hind feet black, the entire back more fulvous than usual, and the tail much darkened with black. In its general appearance, however, it corresponds with *V. v. hoole*.

#### ***Vulpes vulpes tschiliensis* Matschie**

*Vulpes tschiliensis* MATSCHIE, 1908, 'Wiss. Ergebn. Exped. Filehner, X,' pt. 1, p. 160.

A larger northern race of similar coloration to the last.

In describing this fox, Matschie supposed that its chief distinguishing feature lay in having the backs of the ears brown instead of black. The type is a mounted specimen from Peking in the Berlin Museum, and may have been somewhat faded, for another skin from the same locality, he says, has the ears blacker.

A single skin secured by the Asiatic Expeditions from Eastern Tombs, in the same province, can be closely matched by one of the less grizzled, fulvous specimens from Fukien. It has, however, a minimum of black on the feet, and lacks any dark mark on muzzle and chin. But its skull is so much larger than in any of the Mongolian or South China foxes, and in

this respect seems to agree so well with the cranial measurements given by Matschie, that it may perhaps represent a distinct northeastern race and I am therefore retaining Matschie's name for it. The condylobasal length is 157 mm., which is 22 mm. greater than the average of four male skulls from Fukien. Skulls from Shensi and Shansi are of intermediate size to 148 mm. for condylobasal length.

This skull is but little inferior in size to one recorded by Ognev from southern Ussuri, eastern Siberia, under the new name *dolichocrania*, the greatest length of which is given as 167.1 mm., while the same dimension (occiput to front of incisors) in the Eastern Tömbs skull (A. M. N. H. No. 57070) is 165 mm. It may, therefore, prove that *tschiliensis* ranges to the Ussuri region and that Ognev's *dolichocrania* is a synonym of it.

#### ***Vulpes vulpes* ?*karagan* (Erxleben)**

*Canis karagan* ERXLEBEN, 1777, 'Syst. Règne Anim.,' p. 566.

A pallid form, straw-yellow, with rusty on back, neck and shoulders; the paws straw-yellow, with or without black marking.

The collection contains an adult male skin and skull from Tsagan Nor, a skull from Loh, and two young from Tze Tzen Wang, Mongolia, as well as a skin from the Tianshan Range, but all these skins are in such poor condition of pelage through wear and moult, that their true coloration is undeterminable. The feet and noses of the adults, however, appear to be much paler in color than in the more southern foxes of China, so that the specimens doubtless represent a more pallid race, probably close to *V. v. karagan* of the Kirghiz Steppe. In his recent review of the foxes of Russia, Ognev mentions a skin collected by Koslov near Kiakhta and another from the steppes of southern Transbaikalia that seem practically indistinguishable from this race, but it is not clear that the additional forms he names as *V. v. ochrozantha* (Tian-Shan) and *V. v. jakutensis* (south of Yakutsk) are really very different. I am therefore provisionally regarding the Mongolian red fox as *V. v. karagan*.

#### **Felidae**

##### **[*Felis bengalensis bengalensis* Kerr**

*Felis bengalensis* KERR, 1792, 'Animal Kingdom,' p. 151.

A dozen skins from Lichiang and Wei-shi, Yunnan, are referred to the typical race of the small spotted tiger-cat which, according to Wroughton, is found in India from southern Beluchistan to Upper Burma and Tenasserim. Although about the size of a house cat, it may at once be distinguished by the pale mark on the middle third of the back



of the ear and by the absence of a dark tip to the tail. Its essential pattern consists of stripes and spots on an ochraceous ground, as follows: two narrow black stripes, one from the posterior corner of the eye, the other from just below the eye, pass back along the side of the jaw enclosing a white area between them; the lower stripe is more or less continuous across the upper throat with the corresponding one of the opposite side and there are three or four other imperfect blackish-brown collar-marks on the lower throat; a short white stripe borders the inner and upper edge of the eye; four narrow black stripes run from the upper corner of the eyes to the shoulders, with sometimes a narrow median one on the forehead and crown; the two outer of these become broader posteriorly breaking up into large lengthwise blotches over the shoulders; the inner pair likewise becomes interrupted at the shoulders, but from there is traceable as a nearly continuous pair of stripes to the root of the tail; the sides of the body are marked by about five longitudinal rows of elongate spots which may be all black, or more or less surrounded by ferruginous, or the anterior part of the spot may be of the latter color, the posterior part black. These markings are larger in the males than in females. The belly has a number of blackish-brown spots on a white ground. The tail is buffy with ten or more broken rings of blackish.

In the Yunnan series, the ground color is bright buff or yellowish, sharply marked off from the belly which is white. There is a good deal of ferruginous on the shoulder region, not only tinging the ground color but broadly edging the spots and markings. In extreme specimens the body spots may be chiefly bright rusty slightly and incompletely bordered with black, while at the opposite extreme are skins in which the ferruginous is nearly suppressed, so that the markings are nearly all black on an ochraceous-buff ground. To this latter type belongs the skin described as *Felis anastasie* by Satunin, as Lönnberg has recently intimated.

#### ***Felis bengalensis chinensis* Gray**

*Felis chinensis* GRAY, 1837, Mag. Nat. Hist., I, p. 577.

Similar to the typical race in all respects but the back is less clear ochraceous, with a decided gray tinge, and the flanks are grayish.

The collections include a large series of some thirty skins and nearly as many skulls from eastern Szechwan (Wanh sien), Hunan (Yochow), Fukien (Futsing and Yenping), Hainan (Nodoa), and a few other places. They all agree in the somewhat grayish tint to back and sides instead of the clear warm buff to ochraceous of the typical animal. There is much

variation in the pattern and size of the markings. Males are larger, with larger markings than females, and in old age the skulls have a low sagittal crest formed by the union of the temporal ridges, whereas in none of the females seen does this ridge form. Peculiarities of the teeth are the frequent loss of the first upper premolars and in the upper carnassial ( $p^4$ ) the antero-internal lobe is often much reduced in size or it may even (as in a case noted by Lönnberg) be practically suppressed. In old animals the orbit may be closed by the fusion of the postorbital process with the ascending process of the jugal.

Milne-Edwards's *Felis scripta* is either based on this subspecies whose variation in markings is so deceptive, or it may possibly represent a slightly darker race. Probably also that author's *F. microtis* from near Peking is only a small female of the same, for the supposed reduction of the ears is said by Elliot, who examined the type (and spelled the name *macrotis*), to be fallacious, for they are really of normal size. A large skin, perhaps of a male somewhat stretched, but probably representing the same animal, became the basis of Milne-Edwards's *F. decolorata*, also from near Peking. It may later prove that the tiger-cat of North China is a distinct race, in which case the name *microtis* will be available for it, provided this in turn is not identical with Radde's *F. undata* of Amur Land, which is at most a geographical race of *bengalensis*. In the lack of comparable material from North China, however, this point cannot be settled now.

***Felis temmincki dominicanorum* P. L. Sclater**

*Felis dominicanorum* P. L. SCLATER, 1898, Proc. Zool. Soc. London, p. 2, Pl. 1.

About twice the size of a house cat, yellowish brown to grayish brown above, the crown, neck and mid-line of the back bright ferruginous; two short white lines from the inner corner of the eyes continue as dull gray lines to the top of head; a white line from just below the eye to side of neck, bordered above and below by russet and black; backs of ears black mixed with gray centrally; a clear gray patch behind ear; feet grizzled gray; tail like the back, with a black tip and whitish lower median line; belly whitish with a row of dark spots on each side.

Four handsome specimens of this cat were secured by Pope in north-western Fukien. Its range no doubt is more or less continuous across the wooded mountainous parts of southern China to Nepal and the Malay Peninsula. The type locality of *F. temmincki* is Sumatra but no comparisons seem to have been made between Sumatran specimens and those of China, though Lönnberg has shown that a skull from northern Siam is

practically identical in measurements with one from China. An adult skull from Nepal is slightly smaller with more inflated bullæ.

Lydekker in 1908 gave the name *Felis temminckii mitchelli* to the animal of Szechwan on the basis of a single skin, and in 1924 Sowerby described a specimen from Tengyueh, Yunnan, as *F. t. bainesi*. In view of the variation in color among cats, and the fact that the species, like *F. aurata* of West Africa, believed to be closely related, occurs in a rufous and a browner phase, it is likely that these are not valid races. Matschie's *Felis (Catopuma) melli* is undoubtedly a synonym of *F. t. dominicanorum*, as well as *F. t. badiodorsalis* A. B. Howell, proposed in place of *melli*, preoccupied.

In addition to the four typical specimens secured at Kuatun, Fukien, by Mr. C. H. Pope, he obtained a fifth (an adult female) from the same locality which agrees in size and in cranial characters with these but differs remarkably in that, instead of being without markings on the body, it has a distinct color pattern of stripes and spots. Like usual skins of *temmincki*, it has black ears, slightly grizzled with gray in the middle of their posterior side, a clear gray patch behind each ear, grizzled gray feet, and bright ferruginous shoulders and mid-dorsal area. The head and body, however, are marked with a pattern practically identical with that of *Felis bengalensis*. There are two narrow lines of black down the back with a less clearly marked pair external to them, then about four rows of elongate blotches and spots, each with an ochraceous center incompletely ringed by a broken black margin, heavier at the posterior side. A row of blackish spots is present on each side of the belly. The tail, in addition to the usual pattern of ferruginous above, white below, with a black tip, also has about fifteen black bars, much as in the smaller species. At first sight, this animal might be thought a hybrid between *F. t. dominicanorum* and *F. b. chinensis*, both of which occur together here, although the latter is commoner at lower altitudes, but it seems equally probable that it represents either a reversion to a more primitive striped and spotted condition or a retention of the pattern that is probably characteristic of babyhood.

#### ***Felis nebulosa* Griffith**

*Felis nebulosa* GRIFFITH, 1821, 'Descr. Vert.,' p. 37.

Size of a leopard; the grayish-ochraceous ground color has some four or five large blotches on the sides, each outlined in black, forming a rim that is narrower or broken on the anterior side; forehead with many small black spots; two pairs of black stripes from occiput to shoulders,

whence the median pair continues more or less broken on to the base of tail; belly white with elongate blackish spots.

A skin from Yenping, Fukien, and another, smaller with the black marks less developed, from Hainan, represent this species. The slight differences in color and pattern are probably individual, and since Griffith's type was an animal supposed to have come from near Canton, the Fukien skin may be regarded as typical, and Matschie's *Felis* (*Neofelis*) *melli* from Kwangtung a synonym. Material is lacking to determine the status of the Sumatran animal to which Horsfield gave the name *F. macrocelis*.

***Felis pardus perniger* (Hodgson)**

*Leopardus perniger* HODGSON, 1863, 'Cat. Mamm. Nepal,' p. 3.

The type locality of Linnæus's *Felis pardus* has been fixed by Thomas as Egypt, and Hollister shows that skins from the southern part of that country are ochraceous buff, hence somewhat pallid, in ground color. African leopards seem to be either large-spotted or small-spotted, the latter perhaps the more usual condition. The series of eleven from Fukien and eastern Szechwan, secured by the Asiatic Expeditions, are uniformly rich ochraceous in ground color, with a pattern of large spots. There is a spinal series of large black spots forming two rows, while laterally the spots become more nearly circular, either with ochraceous centers completely ringed, or with the rings broken anteriorly or in two or three places. Immature specimens are paler in color than adults.

Although various names have been given to leopards in the East, it can hardly be said that any of them rests upon a satisfactory basis. Cabrera has pointed out that Hodgson's *Leopardus perniger*, based on a melanistic individual from Nepal, is the oldest name available for an Indian leopard, and since it is likely that the animal of South China is the same, I am provisionally using it for the latter. Three leopard skulls from India (two from Amballa) are a little different in the form of the nasals from the Chinese series, in which these bones are slightly more flattened and triangular, tapering to a median point behind instead of maintaining their width farther back and ending in an abruptly rounded outline. These differences are slight, however, and may not hold in a larger series of Indian skulls. Other available names for the eastern leopard are: *melas* of Péron and *variegata* of Temminck, both based on specimens from Java, Matschie's *Panthera hanensis* based on skins from Hing-an-fu and *Felis pardalis sinensis* of Brass applied to leopards of South China. The likelihood is, however, that the latter do not materi-

ally differ from Indian examples. Although specimens from North China are not available to determine the validity of the race currently called *fontanieri* (type locality Peking), Cabrera has suggested that the name *orientalis* of Schlegel (type from Amur) may be found applicable to it instead.

#### *Felis tigris* Linnæus

*Felis tigris* LINNÆUS, 1758, 'Syst. Nat.,' 10th Ed., I, p. 41.

Three handsome tiger skins with skulls, from Fukien Province, do not seem to differ essentially from the only Indian tiger available for comparison. The three are similar in their rich tawny ground-color, but differ in the details of the black stripes. In the adult male, No. 45519, the body stripes are broad, and much broken into lozenge-shaped blotches, with wide borders enclosing a bright rufous center. The stripes on the hips and haunches are, however, clear, wide, and continuous. A second skin shows the opposite extreme, with very narrow stripes, much less broken over the body, but tending to be short or incomplete; while the third is somewhat intermediate, with the stripes more broken and tending to form blotches open on the anterior upper part, enclosing areas of tawny. Hilzheimer (1905, Zool. Anz., XXVIII, p. 594), in comparing five Chinese tiger skulls with three from India, believed that the Chinese skulls could be distinguished by having the highest point of the skull just ahead of the postorbital processes instead of over them, and by lacking a small antero-external supplementary cusp on the upper carnassial, present in Indian skulls. These differences do not seem to hold good, however, for in the three skulls from Fukien the highest point is behind the postorbital process in one, ahead of it in the two others, while the supplementary cusplet of the upper carnassial is well developed in the large male, slightly developed in the second specimen and not at all in the third. Hilzheimer, relying on the report of an expert fur dealer, believed that there are differences in pelage between the Indian and the South China tigers, but it seems doubtful if these are of recognizable value in nomenclature, so that for the present Hilzheimer's name *amoyensis* for the tiger from Yunnan to Fukien may be regarded as probably a synonym. Following Pocock, I retain the generic name *Felis* for the tiger and the leopard, although both may be included in a subgenus, *Panthera*.

#### *Lynx lynx isabellina* (Blyth)

*Felis isabellina* BLYTH, 1847, Journ. Asiatic Soc. Bengal, XVI, p. 1178.

A large short-tailed cat, of a general frosted reddish above, white below with a few blackish spots on inner side of fore limbs and on the

sides of belly; legs and flanks with indistinct reddish spots; a broad white border to the eyelid, interrupted by a black spot near posterior upper margin; cheeks with three or four indistinct stripes of reddish brown; upper half of ear, its terminal pencil, a black spot on the lower cheek, and the tip of the tail, black.

A large skin from fifteen miles northeast of Urga, Mongolia, is interesting as perhaps marking nearly the southern boundary of this lynx's range in this part of Mongolia, where the coniferous forest and its northern fauna reach the edge of the Gobi Desert.









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